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FLIGHT

AIRCRAFT, SPACECRAFT, MISSILES

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IN THIS ISSUE

Canada's Golden Anniversary 280
Getting to Grips with the Stick 284
Tour d'Horizon 286
Jackaroo Paragon 288
Antonov An-10 289
Argosy g.a. drawing 293
New from Bendix 296
Programme-controlled Altitude Chamber 298

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Below Limits

TWENTY years ago weather delays were common enough to be regarded philosophically; but now, with more frequent schedules and a painstakingly achieved standard of operational regularity, the spectres of mist and fog loom large among seasonal airline problems.

While the reasons for the imposition of strict limits on landing weather are clear enough, it may sometimes be asked why, when take-off in practically nil visibility is possible, restrictions must be imposed upon departing aircraft. At London Airport, B.O.A.C.'s and B.E.A.'s Comets, Britannias, DC-7Cs and Viscounts continue to take-off in visibility down to 150 yards. These distances —covered at the unstick speed in roughly three seconds—are the practical minima below which experience dictates that it is not safe consistently to fly. Taking off into the murk on instruments subject to acceleration errors and without a full automatic aid can never be absolutely safe; and each airline must decide the take-off and landing limits at each airfield on its routes.

B.E.A., in particular, are again considering a reduction in their landing minima, and, as European operators, are looking forward to fully automatic blind landing to improve their winter punctuality. Little has yet been said about an automatic take-off aid (which must include provision for taxying), but it is clear that it is a necessary adjunct to automatic blind landing. If a reliable visual or electronic aid can be developed in advance of an automatic landing system, frustrating airport delays should be much reduced.

Sir Dermot and Sir Dick

IN John W. R. Taylor's book *C.F.S.: Birthplace of Air Power* there is a photograph of the aerobatic team for the 1928 Hendon Display, and flanking the group are F/O. Dermot Boyle and F/L. R. L. R. Atcherley. These two young officers typified all that was (and is) best in the R.A.F. They were dashing pilots and accomplished leg-pullers; and, being that sort, they would have been woefully embarrassed if it had become known to them that they would one day be numbered among the greatest leaders of the Service. As the rings and gongs clustered and the scrambled egg encrusted, so their reputations increasingly inspired the young idea. And they remained utterly unspoiled.

Years after they had become important as well as famous Sir Dermot had occasion to specify why a certain Genet Moth in an old photograph could not possibly have been flown by Atcherley. "He is flying level (although admittedly inverted)," he commented. "He is looking where he is going . . . and there are no marks on the aircraft to indicate that it has recently been in collision with its fellows. . . "

Now Air Marshal Sir Richard Atcherley, Air Officer Commanding-in-Chief, R.A.F. Flying Training Command, is retiring, and his erstwhile C.F.S. teammate, Marshal of the Royal Air Force Sir Dermot Boyle, Chief of the Air Staff, pays him public tribute. Again Sir Dermot rises to the occasion. "Dick Atcherley," he pronounces, "was always known as a man prepared to fly anything anywhere, and—if I may say so—anyhow."

Into that smiling salute the C.A.S. distils the essence of C.F.S.—that is, R.A.F. —tradition, and something that will remain long after Sir Dermot has followed his old comrade into the bleakness of Civvy Street.

FROM ALL QUARTERS

R.A.F. Intentions

IN fifty-nine crisp paragraphs forming his memorandum* on the Air Estimates for 1959-60 the Secretary of State for Air, Mr. George Ward, makes some noteworthy disclosures about R.A.F. intentions not touched upon in the necessarily wider context of the defence plan "progress report" (*Flight*, February 13).

Thus, referring to Bomber Command, the Minister says that "a number of V-bombers" will be assigned to SACEUR in the tactical rôle. These squadrons will replace Canberras, the Canberra B.6s at present so assigned eventually replacing the B.2s in the Middle East. Initially, the V-bombers assigned to NATO will be Valiants; and, like the Canberras, they are to be based in this country. The build-up of Bomber Command with Victors and Vulcans continues, and the V-force has now reached a high pitch of efficiency. Six minutes is the standard time from the signal to crews in the crew-room to take-off, and readiness is being further improved.

Making next a reference to Fighter Command and its coming equipment with Lightnings, the memorandum states that these aircraft are to be fitted for flight refuelling to improve the Command's capacity for overseas reinforcement. During 1959-60, a number of Javelin squadrons will be re-equipped with Mk 8 aircraft, while Mk 7s already in service are to be modified for reheat. More Bloodhound sites are to become operational.

The earlier marks of Shackleton in Coastal Command are being modernized to the equivalent of M.R.3 standard. Transport Command is to receive "shortly" the first of its twenty Britannia 253s, after completion of clearance trials at Boscombe Down. A contract is being let for the development of the TSR.2—"a versatile aircraft"—to operate in NATO and overseas commands.

In Germany, the headquarters of the 2nd Allied Tactical Air Force is to have a fully international staff and the R.A.F. element has been re-named Royal Air Force, Germany; re-equipment of the F.A.W. squadrons with Javelins is to be completed in 1959-60. In the Arabian Peninsula, where trials of G/A aircraft were conducted last year, Hunters are to replace Venoms.

The memorandum gives some heartening news on the accident rate, which in 1958 (for both turbojet and piston-engined aircraft) was the lowest ever recorded. But it is rather gloomy on recruitment, pointing out that this has "fallen appreciably short of requirements" in the professional branches and for direct-commission aircrew. It emphasizes that the redundancy scheme has been largely completed; there will be no more redundancies of officer aircrew of squadron leader rank or below. It stresses the continued requirement for aircrew.

The net total of Air Estimates for 1959-60 is £490,800,000 (allowing for the receipt of £2,000,000 from the Federal German Government), compared with a net provision for 1958-59 of £467,050,000, allowing for an estimated receipt of £7,500,000 from Germany. The 1959-60 budget for aircraft and stores—£213,850,000—shows an increase of £17,050,000, principally because of increased expenditure on guided missiles.

Guided-Missile Navy

REFERENCE is made to the Royal Navy's guided missile destroyers and to a new aircraft carrier—*Hermes*—in the First Lord of the Admiralty's explanatory statement† on the Navy Estimates for 1959-60. Lord Selkirk says that two of the four destroyers on order are about to be laid down, and a third will be laid down later this year; *Hermes* is to start her trials by the end of 1959. Another carrier *Bulwark*, is being air-conditioned to enable her to operate with her commando "in the most exacting tropical conditions." Three aircraft carriers will be fully operational throughout the year, being provided from *Victorious*, *Centaur*, *Albion* and from *Ark Royal* when she finishes her refit.

The First Lord refers to the equipment of more F.A.A. squadrons with Scimitars and says that Sea Vixens (to be fitted with Firestreak) are expected to come into Fleet service within a year. NA.39 development is "proceeding satisfactorily." The A.S. squadrons will be equipped with Wessex helicopters in addition to the Whirlwinds already in use; and, as is well known, the Gannet AEW.3 is to replace Skyraiders.

Navaids: British Statement

A STATEMENT issued last week by the representatives of the United Kingdom airlines attending the I.C.A.O. meeting at Montreal was in the following terms:—

"I.A.T.A. and the United States and United Kingdom delegations are in complete agreement that VOR should be retained as an I.C.A.O. standard aid. The disagreement is whether Decca or DMET should become supplementary standards at this time.

"All United Kingdom I.A.T.A. members disagree with the Association's advocacy of DMET as a standard. There is virtually no civil operating experience with this system to date. There are no I.A.T.A. statistics on Decca reliability. In the course of more than 350,000 hr of operating experience United Kingdom operators have found that the reliability of earlier versions of Decca equipment ranges between 90 and 97 per cent. Results from the new Mk 10 equipment are expected to be markedly better. One operator, Silver City Airways, has achieved serviceability figures for 1958 of 98.4 per cent, and of 99.25 per cent in January 1959. They have approximately 26,000 hours' experience with Decca Mk 9 over three years, involving approximately 75,000 flights to date.

"B.O.A.C. and B.E.A. support for Decca results from considerable experience in operating turbojet and turboprop aircraft in high-density areas. B.O.A.C. have also had more operational experience with DME (on 200 megacycles) than the rest of the world's airlines put together."

A.W.A. Directorships

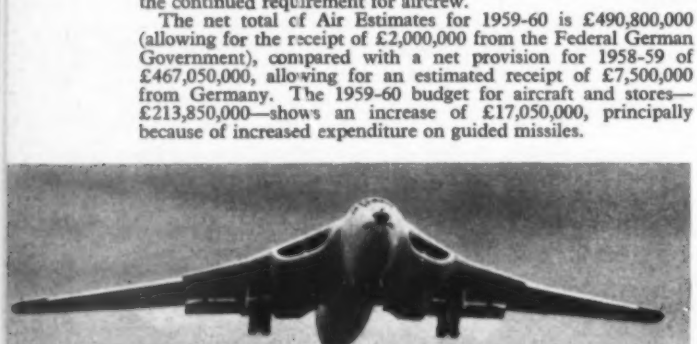
CHANGES in the Board of Sir W. G. Armstrong Whitworth Aircraft Ltd. were announced last week. Mr. H. M. Woodhams was elected chairman and he also retains his position as managing director. Mr. F. Martin, Mr. J. T. Lidbury, Mr. J. A. R. Kay and Mr. S. D. Davies were elected to the Board; and Mr. E. D. Keen and Mr. C. Bayly were appointed executive directors.

Examining the Swallow

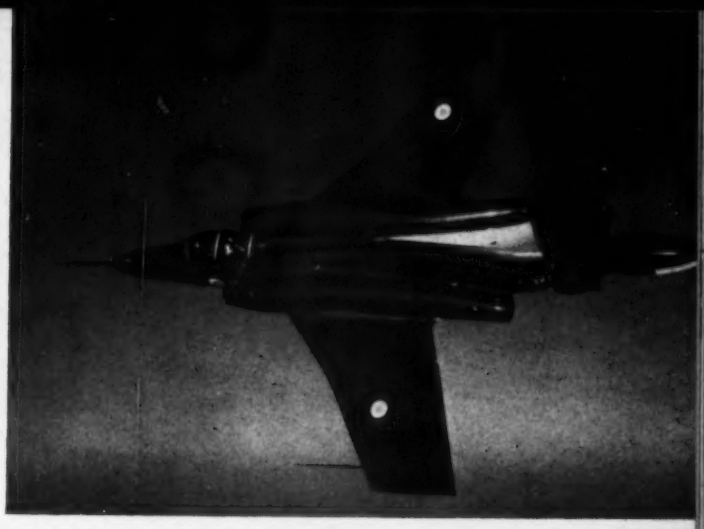
A JOINT Anglo-U.S. research programme on the Swallow variable-geometry concept was announced by the Minister of Supply, Mr. Aubrey Jones, last Monday. Replying to Parliamentary questions by Mr. Roy Mason (Lab., Barnsley) and Mr. Geoffrey de Freitas (Lab., Lincoln), he said that a series of tests and engineering studies would be undertaken—partly at

*Cmnd. 673, H.M. Stationery Office, price 2s.

†Cmnd. 674, H.M. Stationery Office, price 1s 6d.



MIGHTIER YET: The Handley Page Victor B.2, which first flew at Radlett on February 20 (pilot, F/L. J. W. Allam). The new Victor has four Rolls-Royce Conway RCo.11s of 17,250 lb thrust each; enlarged intakes; increased span; and retractable scoops near the fin taking in ram-air for two turbo-alternators which provide high-altitude emergency power. Emergency power for low altitudes comes from a Blackburn Artouste in the starboard wing-root; this provides air to start the starboard Conways, which in turn deliver air to the port units



IN THE NAVY ESTIMATES allusion is made to the Short Seacat missile (a test vehicle is displayed above); the Blackburn NA.39 (fourth example, top right); and the anti-submarine Westland Wessex (first production line, right). Personalities portrayed above are:— Rear Admiral Sir Matthew Slattery, Short's chairman and managing director; Mr. H. G. Conway, deputy managing director and chief engineer; the Rt. Hon. the Earl of Selkirk, First Lord of the Admiralty; Capt. R. E. Washbourn, Naval Secretary to the First Lord; Mr. P. D. Nairne, Private Secretary to the First Lord; Mr. J. Dent, Short's assistant chief engineer (guided weapons)

Vickers, partly at the R.A.E. and partly with American Government research facilities to prove the potentialities and practicability of the concept. This programme would "make use of the considerable work already done by the Americans in this field." The British Government would be contributing part of the cost of the work undertaken at Vickers. If an aircraft were to be built construction would be undertaken in this country.

Agricultural Aviation Conference

A FOUR-DAY international conference on agricultural aviation will be held at the College of Aeronautics, Cranfield, during the period September 14-19. The programme will include practical demonstrations of agricultural flying, and is being organized jointly by the Ministry of Agriculture, Fisheries and Food; the Ministry of Transport and Civil Aviation; the Colonial Office; the European Agricultural Aviation Centre; the Royal Aeronautical Society; the Society of Chemical Industry; the National Farmers' Union; the Association of British Manufacturers of Agricultural Chemicals; the Fertiliser Manufacturers Association; and the National Association of Agricultural Contractors.

The fee for the conference will be £14; enquiries should be addressed to the Ministry of Agriculture, Fisheries and Food, Room 218, Great Westminster House, Horseferry Road, London, S.W.1; or to Dr. W. J. Maan, Director of the European Agricultural Aviation Centre, le v.d. Boschstraat 4, The Hague, Netherlands.

Britannic Appointments at Belfast

WITH a view to concentration of effort on the Short Britannic freighter (*Flight* last week, page 240) Short Brothers and Harland Ltd. are reorganizing their senior engineering staff, which is under the direction of Mr. H. G. Conway, deputy managing director and chief engineer.

Mr. R. Boorman remains chief technical engineer, with overall technical responsibility for stress, aerodynamics, analytical and test activities. Mr. Boorman, who joined Short in 1926, was appointed chief structural engineer in 1954 and occupied this post until he took up his present position in 1957.

Two new appointments are made. Mr. C. D. Hatton, formerly assistant chief engineer, becomes chief designer, Britannic, in which post he will be responsible for all design and development phases of the new aircraft. Mr. Hatton, who joined as a premium apprentice in 1936, was made principal stressman on the Seamew project in 1951 and assistant chief engineer in 1954.

Mr. J. R. Lewin, hitherto chief stressman, is appointed chief airworthiness engineer, with the responsibility of advising all departments on airworthiness matters. Mr. Lewin joined as a stressman in 1928 and after various stress-office and flight-observer posts was appointed chief stressman in 1951.

As the Rolls-Royce Tyne is developed, incidentally, Short Brothers expect the maximum payload of the Britannic 3 which it will power to increase from 75,000 lb to 100,000 lb and the all-up weight to 220,000 lb (from 195,000 lb). This "stretched" version will have a thinner wing of greater aspect ratio and a longer fuselage.

BRITANNICISTS (see above): Messrs. Boorman, Hatton and Lewin

The 504 Club Meets Again

IN spite of influenza and *anno domini* there was an almost complete attendance of Avro 504 Club members at the eighth annual reunion dinner, held last Friday at Londonderry House. The seventh apprentice to be admitted to membership—Mr. Philip E. Hall, best apprentice of his year—received his awards and insignia from Sir Roy Dobson; and Mr. Geoffrey Roe was made an honorary member.

Though it is customary for the majority of the speeches to be reminiscent, Mr. Tom Prince shook guests a little by prefacing his toast of the Avro company with the remark that his first memory of "A.V." dated from 62 years ago. Sir Alliott had "always known what he wanted and, better, how to get it," he added.

Sir Roy Dobson responded for the company and welcomed the guest of honour, Air Chief Marshal Sir Francis Fogarty. Mr. Bob Shipperbottom did an excellent job in welcoming the guests individually.

Sir Francis ("Joe") Fogarty entertained everyone with Service line-shoots by request. In the serious portion of his speech he commented on the excellence of the Avro scientific team, remarking that if this country were to "drop out of the race" we should become "air tramps for ever"; he thought it essential that money be put into manned supersonic flight.

As is usual, the "new" apprentice was invited to speak, and this Mr. Hall did with exceptional ability. Although, he said, it was now customary to work to a tenth of a thou. instead of by chalk marks on the floor, and computers were operated by teams of mathematicians who did not know the blunt end of an aeroplane from the sharp end, he doubted if it was entirely possible to change aircraft design from an art to an exact science. There had to be a touch of genius.

Sir Roy Dobson here confirmed that there was still art in aircraft design, instancing Sir Sidney Camm's conceptions—he had never produced a bad looking aircraft; they were just the right shape without loss of aerodynamic efficiency, and "inside there was always lots of strength."

1909 1959

Canada's Golden Anniversary

ON February 23, 1909, a cable was sent to *The Times* by Dr. Alexander Graham Bell which read "FIRST FLIGHT OF A FLYING MACHINE IN CANADA OCCURRED TODAY (FEB 23) WHEN DOUGLAS MCCURDY A NATIVE OF BADDECK NOVA SCOTIA FLEW A DISTANCE OF ABOUT ONE HALF MILE AT AN ELEVATION OF ABOUT 30 FEET ABOVE THE ICE OF BADDECK BAY IN AN AERODROME NAMED THE SILVER DART." This was not only the first powered flight in Canada—the 50th anniversary of which was celebrated this week with functions at Baddeck and Montreal—but was also the first powered flight by a British subject in the British Empire.

The Aerial Experiment Association, the brain-child of Dr. and Mrs. Alexander Graham Bell, existed from October 1, 1907, to March 31, 1909. Its formation, with the object of "achieving mechanical flight by the construction of a practical man-carrying, power-driven aerodrome," followed Dr. Bell's interest in kites and tetrahedral-cell aircraft. The members of the Association were Dr. Bell, chairman; F. W. (Casey) Baldwin, chief engineer; J. A. D. McCurdy, treasurer and assistant engineer; Lt. T. E. Selfridge, U.S. Field Artillery, secretary; and Glenn M. Curtiss, director of experiments.

The early experiments were carried out at Hammondsport, N.Y. Two of Bell's tetrahedral cell designs, the Cygnet and the Cygnet 2, were built and tested, together with the four more-conventional biplanes listed in the table below. Baldwin's flight in the Red Wing on March 12, 1908, was the first powered flight by a Canadian. The most important innovation introduced on the second biplane, the White Wing, was the introduction of hinged wingtips, or ailerons, for lateral control, as suggested by Dr. Bell and designed by Casey.

McCurdy first flew the White Wing on May 23, 1908, at Hammondsport. Various improvements were made during the development of the third and fourth machines, and McCurdy made the first flights with the Silver Dart at Hammondsport on December 6 of the same year. The historic first flight in Canada was witnessed at Baddeck Bay by over 100 local villagers.

Canada's celebrations of the 50th anniversary of McCurdy's flight are on a nationwide scale, with the overall programme organized by a National Co-ordinating Council. Represented on the council are bodies which include the R.C.A.F., R.C.N., Canadian Army, Department of Transport, Canadian Aeronautical Institute, R.C.A.F. Association, Aviation Writers Association, Canadian Owners and Pilots Association, Royal Canadian Flying Clubs Association, Air Industries and Transport Association, Air Cadet League, National Research Council and Canadian Air Lines Pilots Association.

On the morning of Monday last, February 23, a replica of the original Silver Dart, constructed by the R.C.A.F., was to be flown by W/C. Paul Hartman at a ceremony at Baddeck. The same evening commemorative dinners were scheduled in many cities and towns across Canada. The principal dinner was that held in Montreal under the auspices of the Canadian Aeronautical Institute, at which the Governor-General of Canada, Mr. Vincent Massey, was to be guest of honour. A Comet of R.C.A.F. Transport Command was to be used to ensure the attendance at both the Baddeck and Montreal functions of Mr. McCurdy and other V.I.P.s.

This week's ceremonies were the opening events in the anniversary programme. Among other major projects, a Canadian National Aeronautical Museum is to be inaugurated during 1959, and many historic aircraft models for the museum will be produced by the model contest competition which has been sponsored principally by the R.C.A.F. A special film concerning the anniversary is being produced by the National Film Board, and a memorial is to be unveiled at Baddeck as part of the Canadian Aeronautical Institute's meeting in June.

The article by Mr. McCurdy on the opposite page, and the information contained in the table below, are reproduced from the February issue of the *Canadian Aeronautical Journal* (published by the Canadian Aeronautical Institute), which contains a number of special anniversary features.

BIPLANES OF THE AERIAL EXPERIMENT ASSOCIATION

	Red Wing	*White Wing*	*June Bug (Loon)*	*Silver Dart*
Sponsor...	Selfridge	Baldwin	Curtiss	McCurdy
Started	January, 1908	March 18, 1908	May 24, 1908	July 10, 1908
Completed	March, 1908	May, 1908	June 19, 1908	October 1, 1908 (ex engine)
First flight date	March 12, 1908	May 18, 1908	June 21, 1908	December 6, 1908
Distance (ft)	300	279	485	600
Pilot	Baldwin	Baldwin	Curtiss	McCurdy
Gross weight (lb)	570	605	615	860
Span	43ft 4in	42ft 3in	42ft 6in	49ft
Chord (max.)	6ft 3in	6ft 6in	6ft 6½in	6ft
Chord (min.)	4ft	4ft	4ft 5in	4ft
Wing area (sq ft)	385.5	408.5	370	420
Aileron span	—	4ft	4ft	5ft 1½in
Aileron chord	—	4ft	4ft 5in	4ft
Engine type	8 cyl. V	8 cyl. V	8 cyl. V	8 cyl. V
Rated h.p.	40 (1,800 r.p.m.)	40 (1,800 r.p.m.)	40 (1,800 r.p.m.)	50 (1,600 r.p.m.)
Cruising h.p.	25 (1,200 r.p.m.)	25 (1,200 r.p.m.)	25 (1,200 r.p.m.)	—

THE SILVER DART *By J. A. D. McCURDY*

I HAD spent 16 years of my youth with the Bells in an atmosphere of inventiveness. On finishing university in Toronto and receiving my degree in Mechanical Engineering in 1907, I asked F. W. Baldwin, a student friend of mine, to come home with me to Baddeck. There, one evening, Mrs. Bell suggested to her husband that perhaps he could employ two young engineers in a positive way. We reviewed where to concentrate our efforts. Dr. Bell had been interested in flying machines for a long time and it was decided that our objective would be to build a powered, manned flying machine.

What did we know about flying machines? We had reference books prepared in laboratories, such as Langley's on surfaces and pressures, Bell's own work on centres of pressures related to centre of gravity, and we had our recently acquired university knowledge in mechanical design, stressing and materials.

Our programme was, firstly, to build an initial flying machine and with experience to develop it to overcome any deficiencies, and, secondly, to train ourselves in the art of flying.

In our approach we had Bell's guiding principle, that unless one failed, one could not succeed.

We first built a box-shaped glider for a man to hang on and gained some flying experience by gliding it off small mountains in the area of Hammondsport, N.Y. Balance was obtained by swinging the body. This was not good enough, so we put outriggers on and a flat tail, and managed to glide a good hundred yards. It worked, so we decided to put it together as an aircraft.

Our group then consisted of Bell, Baldwin and myself, and we brought in Lt. Selfridge and Glenn Curtiss, who was a builder of motorcycle engines.

Our work was carried out at Hammondsport, N.Y., and was based on an understanding of mechanics rather than mathematics. We knew that fish-shaped bodies minimized resistance in water, so we applied this principle to all struts and beams. The structural design was empirical. We tapered the wing thickness with span as the load decreased, and we tested various parts of the structure and joints by applying sizeable loads to these and assuring they did not fail prior to being assembled.

For our engine we linked eight motorcycle cylinders together on one crankshaft. We built a propeller of tubes with metal sheet riveted on. We ran the engine with the propeller on a block to see that they would function.

We were great believers in trying things, so we put the machine together, took it out and flew it.

This first machine had tubular runners and was taken off from ice. On its second hundred yard flight it toppled over due to lack of lateral balance. Our second machine was built to have better lateral control by putting movable surfaces on the trailing edge of the wing which were linked to shoulder yokes carried by the pilot. As he was tipped in either direction, he would automatically, by his body movement, control these surfaces—now called ailerons.

The second machine had a tricycle undercarriage with the steerable front wheel linked to the rudder control. This machine which had made flights of up to 1,300ft was cracked up due to pilot error. With the experience gained, we built our third machine—the June Bug. In this machine we made many successful flights—over one mile on July 4, 1908—and in the same machine I made the first figure eight to have been flown anywhere in the world, which proved the machine's manoeuvrability.

We had used the same air-cooled engine in all three machines. The engine had not been damaged in the two crack-ups but in the third machine on a cold flight it seized.

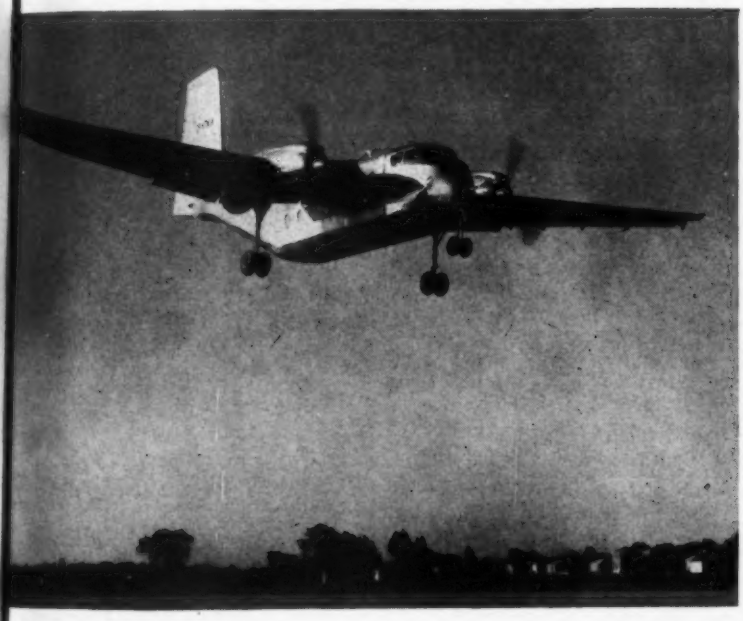
We then built a liquid-cooled engine and our fourth machine—the Silver Dart. This was mostly built at Hammondsport and then brought to Baddeck for final completion and the first flight on February 23, 1909.

For our flight we had the background and development of three previous machines and I had completed more than 100 flights before February 1909.

In two years we had advanced from a decision at Baddeck to fly a powered machine to the first powered flight by a British subject in the British Commonwealth.

What made this possible? We built on experience as it was gained and got on with the job, for one can easily spend too much time thinking and never get around to doing.

Fifty years' progress of Canadian aviation is indicated by these two photographs. The heading picture on the opposite page shows the replica of McCurdy's Silver Dart built by R.C.A.F. personnel for the anniversary occasion. Below is one of the Canadian industry's latest products, the D.H.C. Caribou



ARROW CANCELLATION: THE ANNIVERSARY'S BITTER PRELUDE

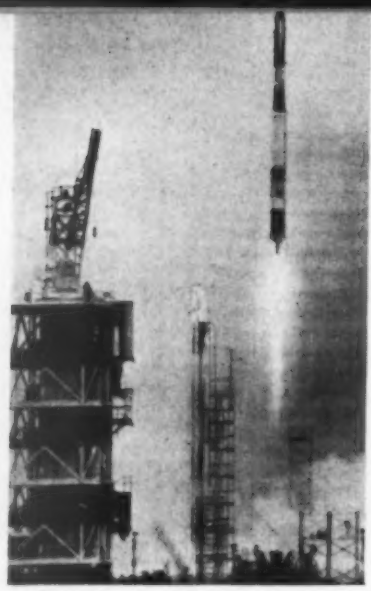
SPEAKING in the Canadian House of Commons on Friday, February 20, Mr. Diefenbaker, the Prime Minister, announced his government's decision to terminate immediately the development of the Avro CF-105 Arrow intercepter and the Orenda Iroquois turbojet. This was followed later the same day by the dismissal, "pending a full assessment of the impact of the Prime Minister's statement," of all employees of Avro Aircraft Ltd. and Orenda Engines Ltd.

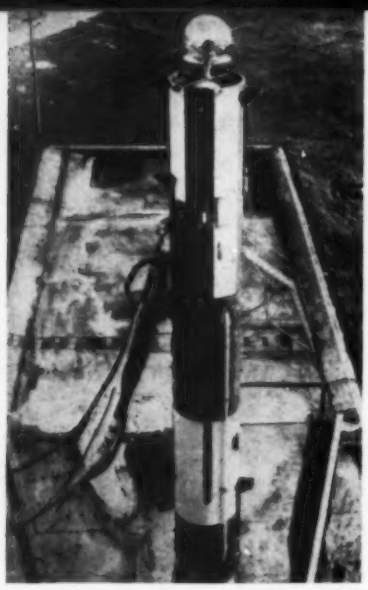
Mr. Diefenbaker said that, in making the decision, the government had made a thorough examination of the probable nature of the threats to North America in future years and the alternative means of defence. The development of the Arrow and Iroquois had been a success, but the achievement had been overtaken by events. "During 1959 and 1960," he continued, "a relatively small number of modern bombers constitutes the main airborne threat. It is considered that the defence system of North America is adequate to meet this threat. By the middle 1960s the missile seems likely to be the major threat. . . . It would only be in this period, namely after mid-1962, that the CF-105 could be fully operational in the R.C.A.F."

Mr. Diefenbaker said that the U.S. Government had considered proposals that the U.S.A.F. might use the Arrow but had concluded that this would not be economical. With the changes in the Arrow's weapon and control system which had been recently announced, it was estimated that the average cost per unit for 100 operational aircraft could have been reduced from about $12.5 million to about $7.8 million. This figure per aircraft included weapons, spare parts and the completion of development, but did not include any of the sum of $303m spent on development prior to September last.

Turning to other aspects of defence, Mr. Diefenbaker said that it had been agreed with the U.S.A. that Canada would pay approximately one-third of the cost of the new Bomarc and Sage projects. The Canadian Government was examining with the U.S. Government the question of the acquisition of nuclear warheads for Bomarc, but Canada would not produce nuclear weapons.

Announcing the immediate dismissal of the work-force of Avro Aircraft and Orenda Engines (estimated at approximately 13,800), Mr. Crawford Gordon, president and general manager of A. V. Roe (Canada) Ltd., said, "We profoundly regret this action but we have no alternative since the company received no prior notice of the decision and therefore we were unable to plan an adjustment."





The successful launching on February 17 of a full-size Vanguard satellite with meteorological payload is reported on this page. These photographs show, from the left, the Cape Canaveral firing; the satellite in place during preparations for the launch; and the upper half of the sphere being lowered into place by technicians at the U.S. Army Signal Research and Development Laboratory, Fort Monmouth, New Jersey

Missiles and Spaceflight

VANGUARD SUCCESS

On Tuesday, February 17, a 20in diameter Vanguard meteorological satellite was successfully launched into orbit from Cape Canaveral, Florida. Weighing 21½ lb, the satellite contained two photo-electric cells (the purpose of which was to obtain an impression of the Earth's cloud cover), a tape recorder on which to store the information, a radio receiver "interrogated" from a ground station during each orbit, and radio transmitters for tracking purposes and for sending data.

The satellite was reported to be the first in a programme of at least four meteorological satellites designed to obtain a global picture of the Earth's weather. Its launching was the fourth in the main Vanguard programme, and the first to successfully place a full-size sphere in orbit.

The main Vanguard satellite launching programme began on May 27, 1958, when the third stage of satellite launching vehicle (SLV) No. 1, together with the satellite, achieved a peak altitude of 2,200 miles and a range of some 7,500 miles. SLV No. 2, launched on June 26, 1958, suffered a similar defect to its predecessor in that the second stage cut off incorrectly, although on this occasion the third stage did not fire. SLV No. 3 was launched on September 26, 1958, and achieved a small number of low orbits before re-entering the Earth's atmosphere and burning up.

As is well known, the Vanguard vehicle-development programme which preceded the satellite launching attempts was dogged with a frustrating series of snags. The complete programme of test launches was as follows: Test Vehicle (TV) No. 0, December 8, 1956, first stage only, successful; TV 1, May 1, 1957, first and third stages, successful; TV 2, October 23, 1957, first stage plus dummy second and third stages, successful; TV 3, December 6, 1957, complete vehicle, first-stage defect when only few feet off stand; TV 3 back-up, February 5, 1958, complete vehicle, control defect during first-stage phase one minute after launch; TV 4, March 17, 1958, complete vehicle, successfully placed six-inch test satellite in orbit; TV 5, April 28, 1958, complete vehicle (first to carry 20-inch satellite), defect in second stage electrical relays caused third stage not to fire.

RECENT ATLAS LAUNCHINGS

A malfunction three minutes after the launching of an Atlas ICBM (presumably an early Atlas C) from Cape Canaveral on February 20 caused the missile to explode after separation of the two booster engines. The last Atlas B, the 20th Atlas to be fired, was launched on February 4 and achieved a distance of some 4,300 miles along the Atlantic missile range.

FRENCH ROCKET PROGRAMME

More than 50 French-built rockets were scheduled to be fired from the Sahara missile base at Colomb-Béchar during this week. Using Véronique and Monica rockets the programme was to be devoted to upper atmosphere research at heights between 30 and 150 miles. The Colomb-Béchar test centre was described in the January 13 issue of *Flight*.

PROJECT START

Initial design of a multi-stage solid-propellant rocket booster "capable of pushing test vehicles to higher speeds and altitudes than those provided by present test systems" has been completed by Boeing Airplane Company. Known by the initial letters of Space Transport and Re-entry Tests, the company states, the system could be built at comparatively low cost from existing hardware. No production is scheduled at present.

ACADEMIC ROCKETRY

A course of lectures on orbital theory and rocket propulsion is now included in the post-graduate aeronautics course at the Imperial College of Science and Technology. Given by Mr. F. G. Irving, the lectures include considerations of planetary motions, escape orbits, re-entry problems, rocket guidance, chemical fuels, electrical propulsion and nuclear powerplants. The 1959-60 syllabus of post-graduate courses at the college has recently been published.

HARD FACTS

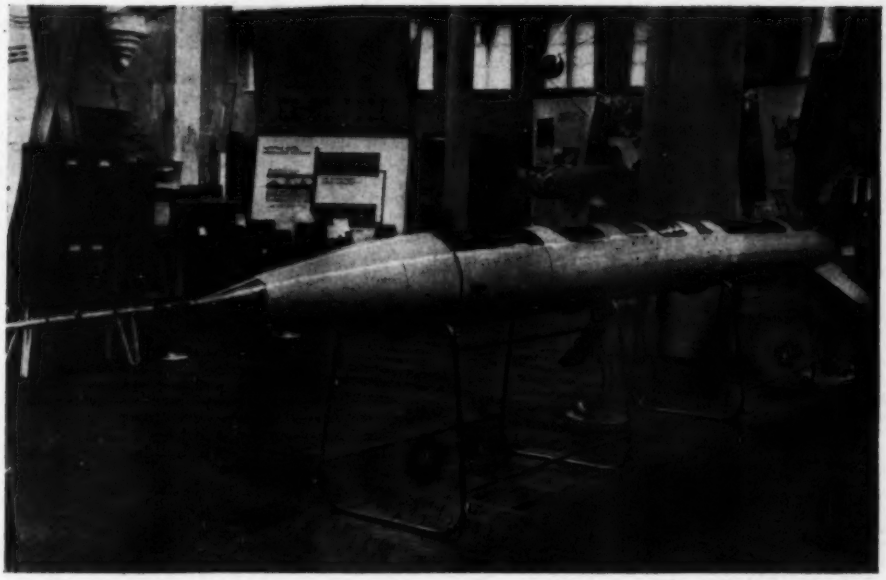
A reminder of the Russian request of December 1957 that the U.S.A. should return the Soviet ball that had fallen in their garden —i.e. the remnants of the first sputnik which were "scattered along a line including Alaska and the west coast of North America"—is contained in a recently published volume in the *Annals of the IGY* series published by Pergamon Press*. The text of the messages from president A. N. Nesmeyanov of the U.S.S.R. Academy of Sciences to president Detlev Bronk of the U.S. National Academy of Sciences, and the reply, form a final brief appendix which precedes the list of references and the index.

The 494½ pages which precede the two messages, however, stick closely to hard facts, even if some of the most detailed facts refer to plans which did not quite materialise. The object of the book is basically to document the rocket and satellite programmes forming part of the International Geophysical Year activity. The account of the IGY rocket programme is particularly good, with full details of the contributions made by Australia, Canada, France, Japan, Russia, Britain and the U.S.A. Every single IGY rocket firing by the U.S.A. is listed, with date, place and principal experiment.

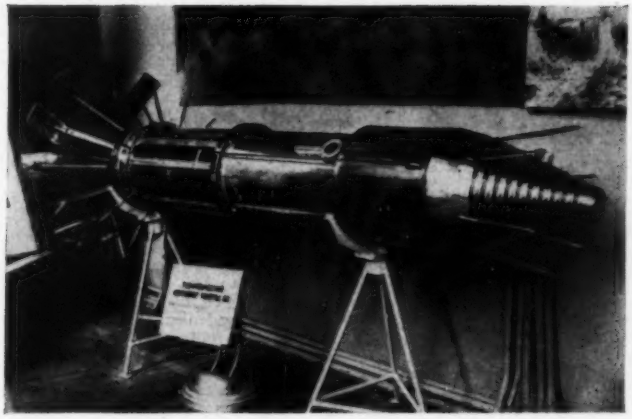
The satellite section is less consistent, in that the U.S. programme did not work out as planned and the Russian descriptions are typically and tantalizingly undetailed. For research workers in the broad field of rocket and satellites, however, the book is an obviously valuable single work of reference. The accounts of actual and planned programmes are backed up by theoretical and practical reviews of what is being attempted, and why. The compilation of all this information represents an impressive achievement.

*"*Rockets and Satellites; Annals of the International Geophysical Year, volume 6,*" edited by L. V. Berkner, Pergamon Press, £8. Illustrated.*

Missiles and Spaceflight . . .

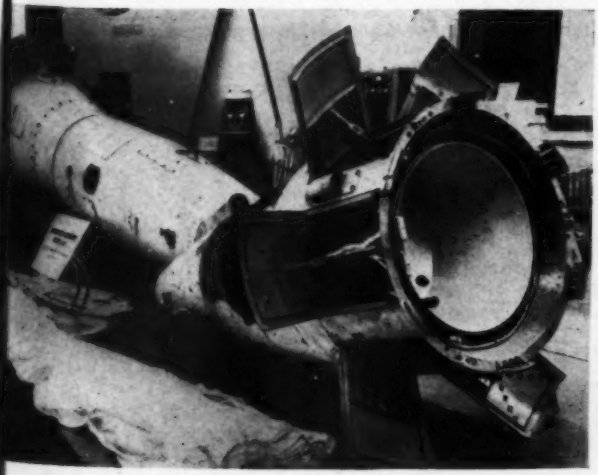


SOVIET ROCKETS ON SHOW



AMONG the exhibits displayed recently in the science pavilion of the Soviet National Economy Achievements Exhibition in Moscow were the rockets and scientific equipment illustrated on this page. Of better quality than most officially released Soviet photographs, these pictures show what are presumably typical items of hardware in the extensive Russian programme of sounding-rocket research

The heading picture shows a meteorological rocket, 23ft in length and 17in in diameter, stated to be fired to a height of 100 km with a launching weight of 725 kg. Background exhibits include sputnik replicas



Upper left, equipment container of the geophysical rocket A3. Equipment weight is quoted as 1,520 kg and maximum height as 473 km

Centre, the geophysical instrument container of the A2 rocket, "which reached an altitude of 212 km when fired." Weight of the container is 360 kg

For left, the instrument container of a rocket said to have come down by parachute after reaching 110 km

Left, "section of a high altitude geophysical rocket, showing two 'dogs' seated in their compartments. Real dogs have been used in tests on the ability of humans to live in Moon-bound rockets"

Getting to Grips with the Stick

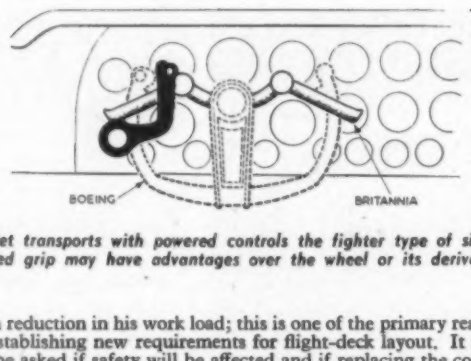
NEW IDEAS IN CONTROL COLUMN DESIGN

By L. F. E. COOMBS

IN aircraft where the control column is nearly horizontal—as is the case with a control wheel, or such derivatives of it as the "ram's horns" of the Britannia—it occupies a useful part of the main instrument panel on which could be concentrated some of the instruments at present placed elsewhere in the cockpit. And sometimes, contrary to accepted precepts of cockpit design, the wheel partly obscures the pilot's view of the instruments when full aileron deflection is applied.

In the early days of flying, as Cdr. H. C. N. Goodhart has pointed out (*Flight*, December 26, 1958) the most satisfactory position for the control column was found to be between the pilot's knees, although this arrangement also obstructs the instrument panel and increases the difficulties of getting in or out. But now, with the advent of fully powered controls actuated through miniature valves, an opportunity arises for a fresh assessment of the best way in which to mount the primary flying control.

If, on analysis, it were found that there is no need to retain the almost universal wheel-type control on transport aircraft, the overall spaciousness of the flight deck might be considerably enhanced. Although the "wheel and pole" provides a simple mechanical solution to the problem of differential aileron and elevator control, the need may no longer exist for such substantial moment-arms as this arrangement provides. With powered controls the functions of the pilot's arm movements are merely to operate the valves and relays of the flight controls and to sense feel-forces supplied from springs or q-pots. Before conventional arrangements are discarded, however, it must be decided whether an improvement can be effected in the quality of the pilot's control



For jet transports with powered controls the fighter type of single-handed grip may have advantages over the wheel or its derivatives

and a reduction in his work load; this is one of the primary reasons for establishing new requirements for flight-deck layout. It must also be asked if safety will be affected and if replacing the control wheel by something else will bring increased mechanical complication.

Before considering entirely unconventional control handles it is worth considering the only worthwhile alternative to the wheel—the fighter-type of articulated control stick—in the context of these questions. Change is not worth making for its own sake, and the fighter type of stick represents quite a drastic change from the wheel. It is doubtful if much benefit could be shown from the aspect of pilot's work load, although there might be some indirect advantages. If a fighter-type grip allows easier arm and hand movements, increases the space around the pilot's seat or simplifies other controls, it must contribute to easing his task.

To decide whether adoption of a fighter-type stick would reduce safety, the case to be considered is the need to prevent sudden application of elevator or aileron while flying at or near Mach 1; since a fighter-type stick occupies physically less space than a wheel, it is probably safer. As far as complexity is concerned, this type of control grip is, in effect, the 12 o'clock spoke of a conventional wheel. The Avro Vulcan is a four-jet aircraft of civil transport size controlled by this type of fighter-type grip. The control grip and pedals are combined into one unit containing feel springs and q-pot which load the "input lever"—the centre of the pilot's hand multiplied by its distance above the axis of the push-pull control column. This system is no more complex than placing the feel devices further downstream in the flying-control circuit.

Another way of looking at the problem is to consider that the controls of a normal autopilot consist of only two or three thumb and finger knobs. This could be the only method of manœuvring the aircraft if it were supplemented by an automatic flight-load detector to prevent overstressing the airframe, and if the complication was thought to be worthwhile.

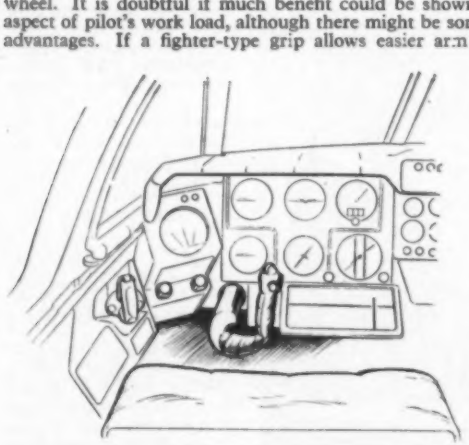
An illustration of the Tu-104 flight deck (*Flight*, January 25, 1958) shows a substantial-looking autopilot control grip mounted at the forward end of the first pilot's right-hand arm rest. An examination of the photograph suggests that the autopilot control grip and associated mechanism are so arranged that the arm rest can still be raised and lowered without affecting its operation. A similar arrangement, whereby a small control grip at the pilot's left hand allowed him to fly in formation whilst on autopilot, was fitted to the Liberator bomber.

So it would seem that there can be few mechanical reasons against the adoption of a fighter-type control grip in the conventional aircraft with powered controls. Safety does not seem to be compromised, because it is no more difficult to apply feel-loads to the pilot's hand by means of a stick than with present systems. Yet a significant improvement appears feasible, and with possibilities of standardization of flight-deck layout.

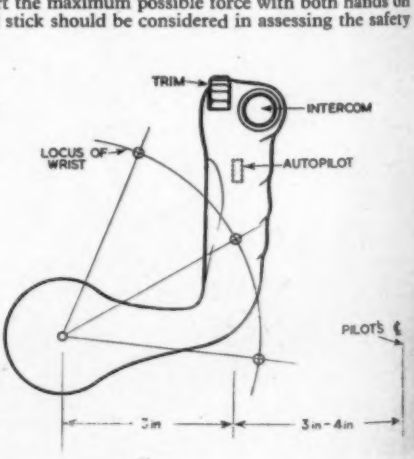
Serious consideration of a control-grip as a replacement for the wheel raises the question of the number required, and where they should be placed.

One of the arguments for getting rid of the wheel is that replacement of the push-pull column would make way for a better principal instrument panel; but to make such a change really worth while it would be essential to show advantages additional to those of the fighter-type grip—a better view of the dials, increase in knee room and more space for new types of instrument.

The possible positions for a stick, other than at the centre, are one at either knee or one only at the outboard knee. It is mechanically possible to have a single grip positioned above and to the side of each of the pilot's knees, so that altogether there are four sticks. This combination of four sticks for four hands is very safe; but in other respects it shows insufficient advantage to balance its extra weight and complexity. The only practical arrangement which completely satisfies all the requirements outlined above (except that of complete safety) is a single stick positioned at each pilot's outboard knee. The possibility of both men losing the use of their outboard hands at the same time seems remote, but the need for one pilot to exert the maximum possible force with both hands on this abbreviated stick should be considered in assessing the safety of the device.



(Left) "The only practical arrangement completely satisfying all the requirements . . . is a single stick positioned at each pilot's outboard knee"



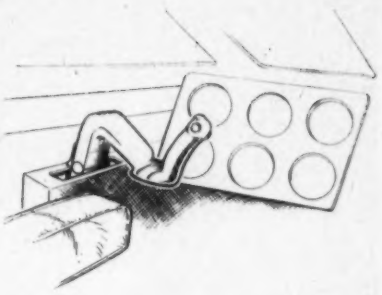
Shown in the diagram at right is the arc of movement (in the rolling plane) of the pilot's left wrist when operating the short stick suggested by the author

If one control grip per pilot is suitable for the R.A.F. (who have accepted it for the Vulcan) it should be satisfactory for pilots of civil aircraft, who are less likely to receive injuries to their hands. To avoid cramping the control-column mechanism by the converging lines of the fuselage, and to keep the instrument panel clear, the stick could be offset by about 3in relative to the 12 o'clock radial of the column centre-line. In an emergency, this would bring it within reach of the other hand.

Whether the arc of movement of the pilot's left wrist would be acceptable could be determined only by extensive flight testing. As shown in an acompanying diagram, the pilot's left hand would hold what is, in effect, the "right-hand" grip of an offset W-shaped wheel—which would be rather like trying to ride a bicycle with crossed hands.

Because this scheme limits normal manual control of the aircraft to the outboard hand of either pilot, it would be necessary to make a careful examination of the other controls and selectors which would have to be operated by that hand. The nosewheel tiller, for example, could remain outboard so that transition to the stick during take-off could be easily accomplished; but controls which might have to be used during conditions of flight where the pilot must use his outboard hand to fly the aircraft must then be located within reach of his other hand.

The question arises whether the control grip should be a straight push-pull device or whether it should move on an arc, the fulcrum of which is at the level of the pilot's foot. Like other details, this too might best be resolved by test and by determining what pilots can get used to. Until recently, the push-pull control seemed to be the accepted method of elevator actuation, but the Lockheed Electra has reverted (if that is the word) to the old-fashioned pole hinged on the floor.



An alternative single control grip could be a vertical extension of a horizontal arm pivoting about a fulcrum in the side of the fuselage

Getting the control column or grip clear of the centre part of the principal instrument panel will be of even greater value when it is necessary to provide pilots with pictorial presentation of navigational information. It will also provide additional space for storm-warning radar. At present both these items have to take their chance on whatever part of the flight-deck surface remains unoccupied by other equipment.

EAST AFRICAN AIR SURVEY

A MAJOR photo-reconnaissance mapping survey in Somalia, East Africa, was recently begun by three aircraft of Spartan Air Services (Eastern) Ltd., Nairobi, an associate of the Canadian Spartan Company. The survey is being carried out for Frobisher, Ltd., Toronto, a major mining firm which has acquired oil exploration licences for 70,000 sq miles in the south of Somalia and 8,000 sq miles in the north of Kenya. The aircraft are based at Mandera, Kenya, and processing of the results is at Nairobi.

HEATED MOMENTS

TESTS have been carried out at the U.S.A.F. Aero Medical Laboratory at Wright Patterson A.F.B. to determine human ability to withstand extreme heat for brief periods, such as during re-entry of a manned space vehicle. One of the research specialists, Dr. Paul Webb, was one of six volunteers who underwent exposure to extreme temperatures first naked, then lightly clothed and finally heavily clothed. The peak temperatures lasted for less than a minute and a naked subject was able to stand a slow heat-pulse reaching a peak at 350 to 400 deg F. A lightly clothed man withstood about 450 deg while a heavily clothed man hardly felt the heat until 500 deg was reached.

MAKING LESS NOISE

TWO symposia dealing with the problem of noise and vibration are being sponsored by the acoustics group of the Physical Society. The first, under the title *Recent Studies of Noise Problems*, is to survey recent work on the measurement and effects of noise. There will be contributions on certain aspects of aircraft and automobile noise and the meeting is open to all without formality. It is being held on Tuesday, March 24, in the Physics Department, Imperial College, London, S.W.7, starting at 2.15 p.m.

The second symposium is a joint meeting with the Institute of Physics, on *New Techniques in the Analysis of Noise and Vibration*, to be held in the Physics Department of Southampton University on April 7. It will include contributions from both practical and theoretical aspects on the use of correlation techniques, of digital computers for data processing and analysis, and on general applications of statistical communication theory. Further details may be obtained from D. M. A. Mercer, Physics Department, Southampton University.

DISCUSSING SUPERSONIC TRANSPORTS

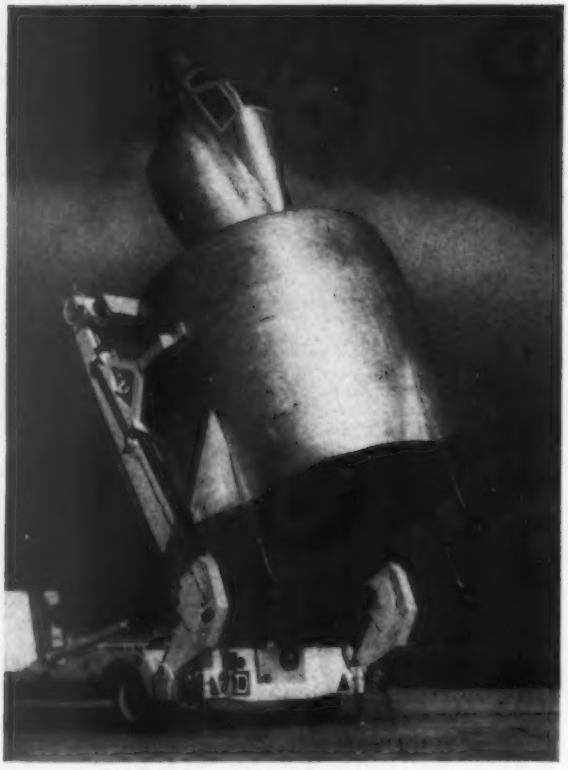
A REGIONAL meeting of the Institute of the Aeronautical Sciences, on the subject of supersonic transports, is being sponsored by the San Diego section and will be held there from May 26 to 28. The tentative agenda includes economic aspects of supersonic transports, design philosophies, systems design, operational problems and propulsion development. One or more sessions will be security-classified.

The meeting's general chairman is C. L. Blake, staff engineer for Convair, and abstracts of proposed papers or suggestions should be sent to him by March 1 at the following address: I.A.S. Supersonic Transport Meeting, 3380 North Harbor Drive, San Diego 1, California.

AEROMEDICAL BIBLIOGRAPHY

A COMPREHENSIVE annotated bibliography of aviation medical literature for 1953 is due to be published this month by the American Aero Medical Association, in co-operation with the Library of Congress, which two years ago published a similar record of 1952 aeromedical literature. This new volume (*Aviation Medicine: An Annotated Bibliography. Vol. II*) includes titles of Russian work on the subject for the first time; it contains 1,386 references and abstracts from nearly 200 U.S. and foreign journals. Subsequent volumes will contain reports from the relevant literature of 1954 and onwards. The present bibliography is available from the publication office of the Aero Medical Association, 2,642 University Avenue, St. Paul, 14, Minnesota. The price is $5, including postage in the U.S. and Canada.

STILL GOING STRONG: Two elderly piston-engined aeroplanes which are still giving good service in the U.S.A. At left is a modified Curtiss S82C-5 used at Moffett Field, California, probably for evaluation of equipment intended for very high-speed aircraft; the rear cockpit is raised and has a periscope. The twin-engined airliner is a Boeing 247D with clipped wings and BT-13 (Wasp Junior) powerplants. Both photographs are by Warren M. Bodie



The SNECMA C.450 Coléoptère being set up by its transporter/erector. The annular wing contains fuel and surrounds the Atar powerplant

TOUR D'HORIZON

French Official Aircraft Programmes

DURING the financial crises of the past two years in France the official orders for aircraft have been considerably, and often confusingly, modified. In order to get production under way, even when funds have been drastically cut, a system of ordering in batches (*tranches*) has been instituted so that an order for a certain number can be placed as a first instalment to be increased by funds from subsequent budgets. The following is a summary of current orders and progress, arranged alphabetically under manufacturers.

Boisavia. Construction of Mercureys for private customers is proceeding slowly. Four prototypes of the twin-engined Anjou are now being extensively modified following the first series of flight tests.

Bréguet. A batch of 15 Saharas was originally ordered and construction begun. The number was then cut to four, the first of which has now flown. The components of the remaining 11 are stored and are to be sold for civil use. Between 150 and 200 Alizés were ordered but only the first batch of 75 has been paid for. Six Alizés are now flying, including two prototypes, and the first true production aircraft should fly in May. The 940 STOL prototype is beginning its short-landing trials and lateral control deficiencies have been cured. One prototype of the larger military 941 Intégral has been paid for and the machine should fly towards the end of 1960.

All work on the Taon lightweight strike fighter has now ceased and the two prototypes are stored. Glider production is progressing apace, 100 Fauvettes having been ordered. Some are being sold in kit form.

Générale Aéronautique Marcel Dassault. The Mirage III recently began a series of low-level, high-speed trials in connection with its declared ability to fill both the strike and intercepter rôles. During earlier tests it reached 59,000ft, Mach 2 and manœuvred under these conditions carrying its Nord 5103 missile. Next month, high-altitude tests will be made with the SEPR rocket motor supplementing the Atar 9, and the ceiling may be raised to 72,000ft. Three aircraft should soon be flying and the pre-production batch of eight should be completed by the end of the year. A production batch of 100 has been paid for.

The original order for 150 SMB2 Super Mystères is to be completed by the end of this year. One prototype of the carrier-borne, Atar-powered Etendard IVM is now flying and the first of a pre-production batch of six or eight should fly soon. A first batch of 50 has been ordered for the carriers *Clémenceau* and *Foch*.

The first flight of the Mirage IV supersonic attack aircraft is imminent. As the operational requirement has been considerably modified during the last three years, any production version would virtually be a new aircraft. The prototype will certainly provide valuable experience of supersonic flying with a fairly large aircraft.

A new and potent entry in the twin-turboprop tactical competition is the MD.415 Spirale (two Turboméca Bastans), which should fly during the coming month. The MD.410 Communauté is a liaison transport version. These types conform to the same specification as the Sud Voltigeur and Diplomate and will hotly compete with them for an eventual production order.

Max Holste. About 350 MH.1521 Broussards have already been built to both military and civil order and construction continues. The Super-Broussard will fly in about two months' time, powered by two Wright R-1300 engines. Production versions will be offered with a choice between Wright, Bastan or de Havilland Gnome engines.

Hurel Dubois. The last of the eight HD-34 survey aircraft ordered for the Institut Géographique National has just been flown and the company is now engaged largely on sub-contract work.

Morane Saulnier. Two prototypes of the Epervier are now flying and are reported to be doing very well. Production of the

From top to bottom, at right, the prototype Dassault Etendard IV Marine with airbrakes out and saw-toothed leading-edge drooped; the Nord Griffon turbo-ramjet research aircraft; and the Dassault Mirage III-001 with shock-cones at the intakes

A Dassault Etendard IV surrounded by stores, including the two 30 mm cannon and the rocket pack which can be accommodated alternatively in a fuselage bay. The Marine Etendard does not have the low-pressure tyres shown here

The views below show, from top to bottom, the Nord 3400 army observation aircraft, the Nord 3200 army training machine and the Sud SE.116 Voltigeur prototype with Wright engines. The large perforated air-brakes allow extremely steep, slow approaches and very short landings

MS.760 Paris is also well under way and 26 sets of components have been shipped to the Argentine for assembly there. Two complete Paris have been delivered to the U.S.A., one to the Shah of Persia and another to this country, for the College of Aeronautics at Cranfield. A third was due to be delivered to the U.S. this month. Fifty Paris have been ordered for the French forces and seven should by now have been delivered.

Potez Air Fouga. A series of 320 Magisters is now being completed and a pre-production batch of carrier-borne Esquifs is being built. A first batch of 30 of the latter has been ordered. Future developments include a single-seat attack version and a four-seat transport version of the Magister. Licence production is in hand in Germany and Israel.

Sud Aviation. Airline orders for Caravelles have been detailed from time to time in *Flight*. Of Djinns and Alouettes 150 and 320 respectively have been built. A few more Djinns are to be produced for both civil and military customers and a total of 400 Alouettes is planned. The Sud 3200 transport helicopter, powered by three turbines, is to make its first flight next month. Only the prototype has been provided for in this year's budget. The original order for 360 Vautours of all three versions was cut to 180 and these should be completed by the end of the year.

Two SE.116 Voltigeur prototypes have so far flown, one powered by Wright R-1300s and the other with two Turboméca Bastans. The latter was destroyed during a test flight recently. Projected production versions are the SE.117 Voltigeur for tactical use and the SE.118 Diplomate for liaison. Although the Voltigeur's original competitor, the Sipa 1100, fell by the wayside some months ago, the Voltigeur now has a very potent challenger in the Dassault Spirale.

Nord. Production of 230 Noratlas is virtually complete, but production under licence in Germany is now well under way. A small batch of the 2502 civil variant with tip-mounted Marboré boosters is in hand and the 2504 crew-trainer for the French Navy is being built. The 2506 assault transport (with Marboré boosters, adjustable and locking undercarriage, high-lift flaps and many other refinements) was to succeed the 2501, but has not been ordered. A few of the more powerful, Pratt & Whitney-powered 2508s with Marborés are being built.

An order has been placed for 100 Nord 3200 tandem, two-seat trainers for the Aviation Légère d'Artillerie de l'Armée de Terre (ALAT). The same number of Nord 3400 high-wing observation aircraft is being built for the French army.

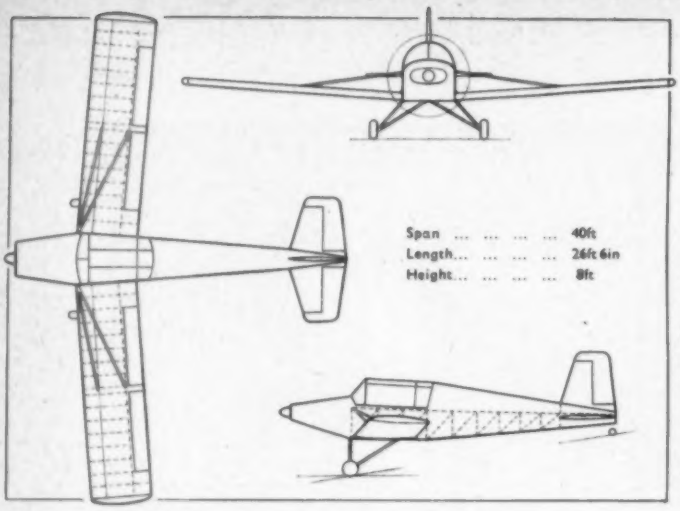
The Gerfaut delta-winged research aircraft is now being used for flight-testing the GAMD Super Aida fire-control radar. Tests with both the Griffon I and II turbo-ramjet research deltas are continuing with good results. The design of a Super Griffon, capable of Mach 3 or 4, is complete but funds for its construction are still awaited.

SNECMA. Tethered tests of the C.450 Coléoptère are almost complete and translation from tail-sitting to horizontal flight should begin during the next two months. It is hoped that the full sequence of take-off, translation and return to vertical landing will be publicly demonstrated during the Paris Show in June.

SFERMA. Flight tests of the Bastan-powered Twin Beech are continuing satisfactorily. A considerable number of surplus Twin Beech fuselages in the United States may well be converted to take these engines.

Société Aéronautique Normande. Production of the very successful two-seat D.117 has recently been handed over to Alpavia to allow concentration on the four-seat D.140 Mousquetaire and the three-seat DR.100 Ambassadeur. There are, of course, no government orders for these machines, but subsidies are given to purchasers or to those who build their own aircraft.

Wassmer. Equally supported only indirectly by the government, this company is producing the two-seat D.120 Jodel variant and has designed a completely new, all-metal three-seater similar in external appearance to the Piper Comanche. Javelot single-seat and Bijav two-seat gliders are being produced in kits or complete.



JACKAROO PARAGON

New Four-seater Designed at Thruxton

AN attempt to meet the frequently stated need for a new British light aircraft, reasonable in cost and versatile in application, is being made by Jackaroo Aircraft Ltd., of Thruxton Aerodrome, near Andover. Design of the machine, known as the Jackaroo Paragon, has been completed, and it is hoped that the first of two prototypes will fly in the spring of next year.

The basic aim was to produce an aircraft that could be used not only as a trainer and tourer for club and private use, but also as a light freighter and general agricultural type. In the opinion of S/L. J. E. Doran-Webb, managing director of the Jackaroo company, such a machine would have a world-wide market.

In the absence of a suitable British engine at the present time, the company have specified a 180 h.p. Lycoming for the Paragon. Simplified construction and simplified maintenance have been the two main objects throughout the design of the aircraft and, on the basis of a minimum of 50 machines produced in the first year, the selling price per aircraft is quoted as approximately £2,500.

The following description of the Jackaroo Paragon is based on the specification of the machine compiled by Mr. Eric Smith, D.C.Ae., A.F.R.Ae.S., chief designer of the company.

As a four-seat cabin aircraft for private flying, the Paragon has a rugged and easily maintained structure. Night-flying equipment, radio and other optional equipment can easily be fitted. Occasional luggage is accommodated on a shelf behind the rear bench seat, and there is a 15 cu ft baggage space, also behind the seat.

For agricultural work the aircraft can be fitted with an 80-gal spray tank, or a dusting hopper, in place of the rear bench seat. Spray-booms or wingtip atomizers—or both—can be fitted if required, and filling will be by a 6in-diameter filler neck on the starboard side.

Freight-carrying can be accomplished by removing the rear seat and utilizing the baggage and seat space. Lashing-rings which pick up on the seat rails are provided.

The fourth main rôle envisaged for the Paragon is that of training. At a gross weight of 1,800 lb the aircraft is fully aerobatic with a crew of two, and the wide cabin (approximately 4ft across the front seats) is well suited to side-by-side dual instruction. The aircraft comes into the semi-aerobatic category at a gross weight of 2,400 lb (pilot plus 770 lb freight; or pilot, three passengers plus 260 lb baggage), and normal-category weight is 2,500 lb.

Construction. The fuselage employs two identical steel-tube side-frames of Warren-girder construction running from the dashboard to the rear wedge. These side-frames are joined by tubular cross-struts, the assembly then being plan wire-braced to form a box-type fuselage. The non-load-carrying upper fuselage is ply or aluminium-covered and is removable for inspection and maintenance. The lower fuselage structure is fabric-covered.

The wings are of constant 5ft chord, and port and starboard halves are interchangeable, wing root fittings serving to attach the wingtip fairings when positioned outboard. Flaps and ailerons are identical in size. Wing construction is normal two-spar type and employs tubular steel spars and pressed light-alloy ribs. Each wing is braced at its mid-point by two struts, from the spars to the top longeron, and is fabric-covered, except for the light-alloy-skinned leading edge.

The tailplane is a complete assembly incorporating the fuselage rear wedge. Vertical and horizontal surfaces are interchangeable; all surfaces are fabric-covered and are operated by torque tubes.

Powerplant of the Paragon is a Lycoming O-360-A1A developing 180 h.p. at 2,700 r.p.m. for take-off and 135 h.p. at 2,450 r.p.m. for 75 per cent cruise. Fuel consumption at cruise power is 10.5 gal/hr. Standard items include self-starter and fuel pump. The engine mounting is attached by means of four studs to the basic fuselage structure at the fireproof bulkhead. Fuel capacity is 40 Imp. gal in two 20-gal inter-spar wing tanks, which can be withdrawn through the wing-root rib for inspection.

In the cabin, the two front seats are adjustable fore-and-aft and a bench-type rear seat is fitted. The cabin floor is mounted on four longitudinal beams to which the seat rails are fitted. All control rods are located under the floor, and the floor, seats and controls are removable as an assembly. The upward-opening doors are 4ft long and incorporate sliding windows. Three tubular-steel hoop members form part of the canopy as a safety precaution for agricultural flying, and the windscreen is of Perspex.

Dual flight controls will be standard equipment in the aircraft, with centrally mounted throttle, flaps, trim and other main functional controls. When the machine is used for agricultural work the controls for spraying or spreading will be duplicated, enabling the training of agricultural pilots to be carried out.

The tailwheel-type undercarriage has soft-suspension main gear (using long spring tie-rods) and a fully castoring tailwheel. Palmer cable-operated brakes are fitted to the main wheels.

Jackaroo Paragon (180 h.p. Lycoming O-360-A1A)

Span, 40ft; length, 26.5ft; height, 8ft; wing area, 180 sq ft; gross weight, 2,500 lb; wing loading, 13.9 lb/sq ft; wing section, NACA 23012 (constant 5ft chord); flap area, 16 sq ft; tailplane area, 32 sq ft; undercarriage track, 9ft.

Cruising speed, 120 m.p.h.; s.l. rate of climb, 800ft/min; distance to 50ft, 850ft; endurance, 4 hr; range, 480 miles.

WARRINGTON DIRECTORSHIPS

TWO directorial appointments have been announced by Electro-Hydraulics Ltd., Warrington, and one by its associated company Conveyancer Fork Trucks Ltd. The new directors of the former concern are Mr. A. Harold, A.F.R.Ae.S., who is on the Board of Conveyancer Fork Trucks and chief engineer of Electro-Hydraulics; and Mr. P. Edwardes, A.C.W., A.C.W.A., director and secretary of Conveyancer Fork Trucks and secretary of Electro-Hydraulics. Mr. T. C. Wright, who is director and works manager of Electro-Hydraulics, has been appointed to the Board of Conveyancer Fork Trucks.

AWARDS FOR METALLURGISTS

APPLICATIONS are invited for the award of Mond Nickel Fellowships for 1959. Their main object is to enable selected applicants (of British nationality and educated to university degree or equivalent standard) to obtain additional training and wider experience in industrial establishments at home or abroad, so as to equip them better to appreciate the significance of research and apply its results, if they are subsequently employed as executives or administrators in the British metallurgical industries.

It is hoped to award five fellowships annually, of an approximate value of £900 to £1,200 each, and tenable for a full working year. There are no age limits (though in practice awards are seldom made to those over 35); and applicants are required to define their programme of training and supply details of their education, qualifications and previous career. Full particulars and forms of application may be obtained from the Secretary, Mond Nickel Fellowships Committee, 4 Grosvenor Gardens, London, S.W.1. Completed forms must reach the secretary not later than June 1 this year.

TOUCH AND GLOW

AS recorded in a news-item last week ("Anti-Collision Liveries?" p. 238), fluorescent Day-Glo paint is being used on M.T.C.A. aircraft. This paint, manufactured in the U.K. by Dane & Co. Ltd., Sugar House Lane, Stratford, London, E.15, is used extensively in the United States both on civil and U.S.A.F. aircraft. It has also been used at an American civil airport (Santa Monica Municipal) to paint the runway-light cones, making them visible to pilots in the daytime before other landmarks. At night, it is said, their lights are reflected by the fluorescent paint, "giving the appearance of a row of bonfires." Day-Glo does not, however, have any phosphorescent qualities.

Its original manufacturers are Switzer Brothers Inc., of Cleveland, Ohio, with whom Dane & Co. have had a licence manufacturing agreement since 1950.

СВОБОДНЫЙ
ТУРБОВИНТОВОЙ
ВЫСОТНЫЙ
САМОЛЕТ
TURBOPROP
AIRLINER
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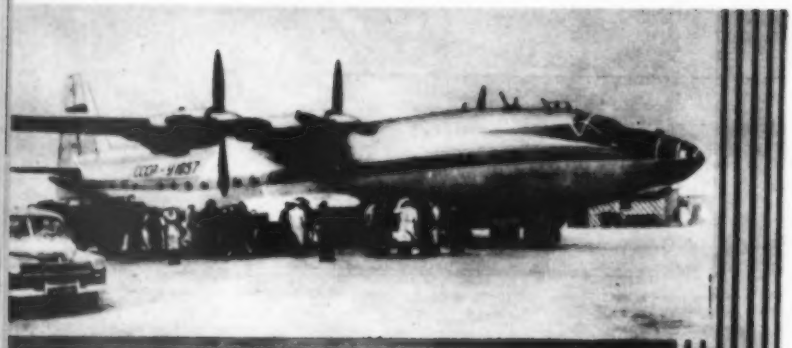
AIRLINER



Советский пассажирский самолет Ан-10 с четырьмя турбовинтовыми двигателями мощностью по 4000 л.с. ... обладает высокими взлетно-посадочными характеристиками и снабжен тормозными щитами ... малым удельным давлением на грунт. Самолет может эксплуатироваться на грунтовых аэродромах с травяным покрытием.

Низкое расположение фюзеляжа относительно земли облегчает загрузку багажных помещений под полом пассажирских кабин; благодаря высокому расположению крыла обеспечивается хороший обзор из всех окон и свободное движение транспорта на аэродроме.

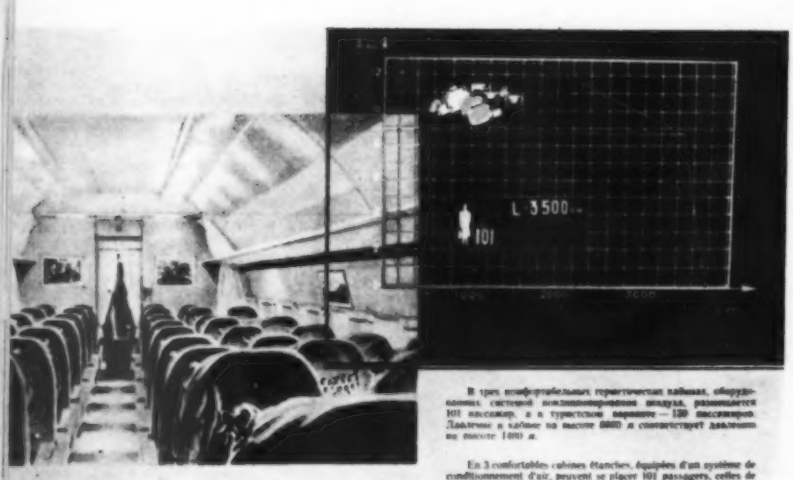
L'An-10, avion rapide de passagers à 4 turbopropulseurs ... la puissance de 4000 ch-e chacun, a de hautes performances, il est équipé d'un atterrisseur à plusieurs roues ce qui donne une petite pression par unité de surface sur le sol. On peut exploiter cet avion sur des terrains gazonnés.

La position basse du fuselage par rapport au sol facilite le chargement des soutes à bagages situées au-dessous le plancher des cabines de passagers, la position haute des ailes permet d'avoir une bonne visibilité de toutes les fenêtres et donne aux véhicules la possibilité du libre déplacement sur l'aérodrome.

PAGES FROM A BROC

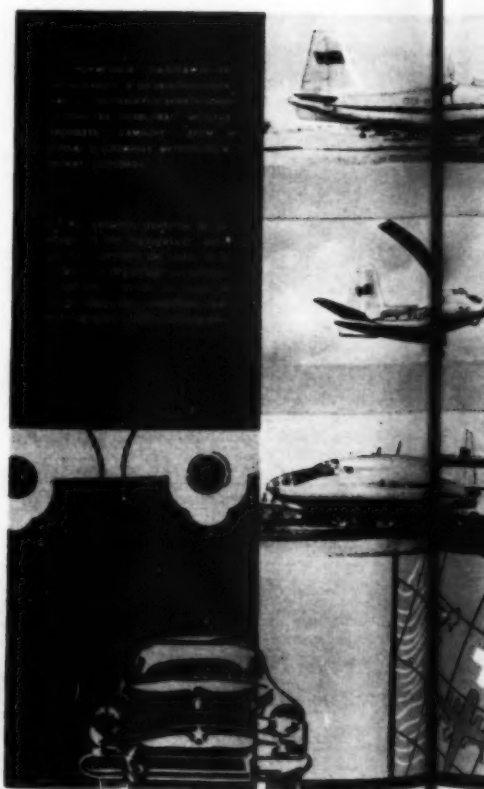
Antonov An-10

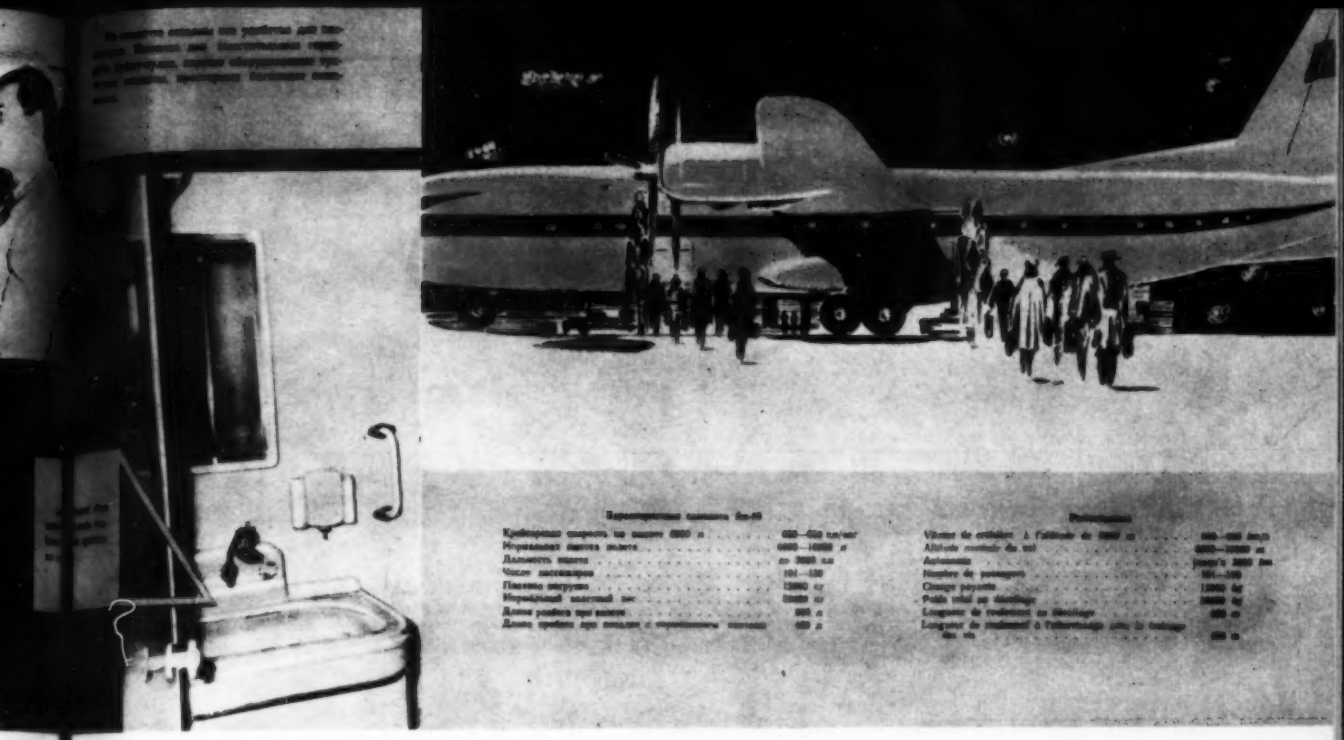
An article on the An-10 appears on pages 289 and 292



В трех комфортабельных герметических кабинах, оборудованных системой кондиционирования воздуха, размещается 101 пассажир, в туристском варианте — 130 пассажиров. Давление в кабине на высоте 4000 м соответствует давлению на высоте 1600 м.

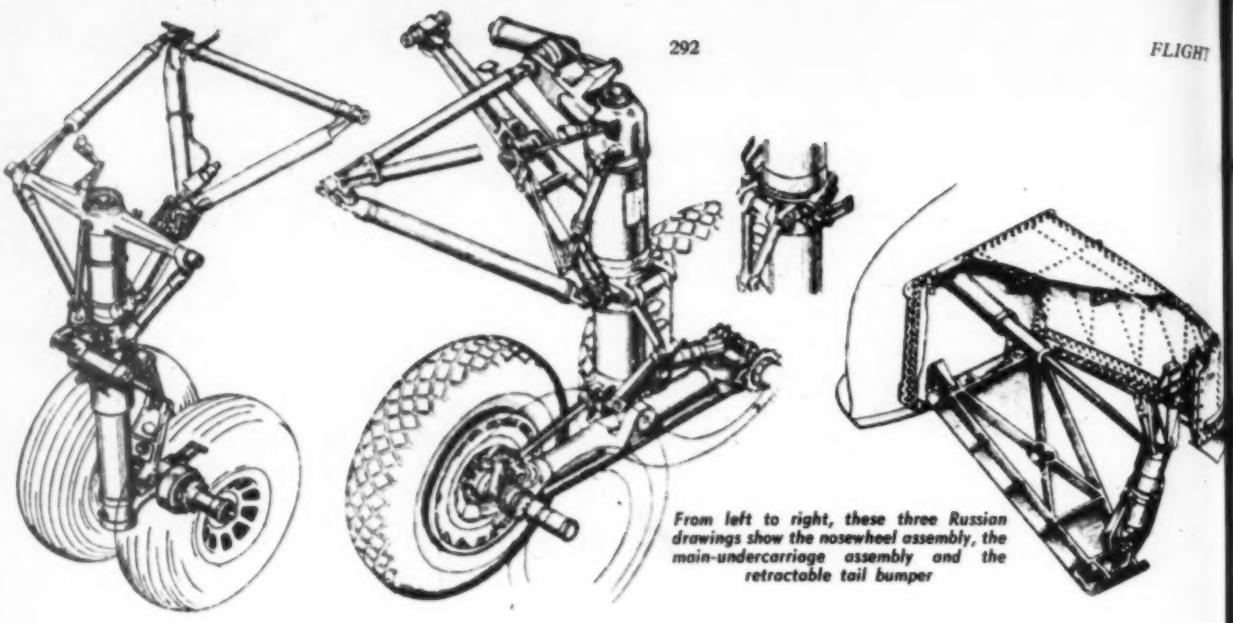
En 3 confortables cabines étanches, équipées d'un système de conditionnement d'air, peuvent se placer 101 passagers, celles de la version touriste sont destinées pour 130 passagers. La pression à l'intérieur de la cabine à l'altitude de 4000 m. correspond à celle de l'altitude de 1600 m.





Performance

Cruising speed at 26,250ft, 370-390 m.p.h.
normal cruising altitude, 19,700-32,800ft;
range, up to 1,860 miles;
number of passengers, 101-130;
payload, 26,450 lb;
all-up weight, 110,200 lb;
take-off run, 710 yd;
landing run (with propeller reversing), 490 yd.



From left to right, these three Russian drawings show the nosewheel assembly, the main-undercarriage assembly and the retractable tail bumper

Antonov An-10 (continued from page 289) . . .

spars, are of the high-strength light alloy B-95 [V-95], while all other structure members are of an Al-Cu-Mg alloy. The wing is divided into the centre section, two intermediate sections and two tip sections. The centre section is of two-spar stressed-skin construction, and the intermediate sections have two spars connected to form a stiff box structure, the rear part housing the double-slotted Fowler-type flaps. The maximum flap deflection of 41 deg gives an increase of $\triangle C_L = 1.0$ in lift coefficient, thus contributing to the low landing speed. The tip sections are similar to the intermediate sections. Wing profile "varies throughout the span, thus giving effective aerodynamic twist."

The landing gear consists of the nosewheels and mainwheels and a tail-skid. The nose-gear unit has twin wheels (without brakes). The wheels have a common axle, suspended on an oleo-pneumatic leg and having a stroke of 420 mm. The nosewheel may be turned 35 deg to the left or to the right. Wheel steering control is hydraulic, and the leg has a built-in hydraulic damper.

The main landing-gear units have four braked wheels, built into one bogie unit; tyre size is 1,050 × 300 mm. Hydraulic disc brakes are used. The oleo legs "again use nitrogen instead of air" and have an effective stroke of 340 mm. A tail-skid serves to protect the rear section of the fuselage "if the aircraft attitude exceeds the prescribed limit angle." The gear can be lowered in 10 to 12 sec.

The Russian description concludes: "The hydraulic system serves for actuating the landing gear and the flaps. Hydraulic power is also provided for nosewheel steering, for braking, window cleaning and for supplying certain instruments, among them the autopilot. Rated fluid pressure equals 150 kg/sq cm [2,140 lb/sq in]. The hydraulic system consists of two parallel-connected, independent units, each fed from two hydraulic pumps driven by the engines on the respective side of the aircraft. An auxiliary system may be actuated by a hand pump. Stainless steel tubing has been used throughout.

"The rudder is supported in three bearings, the lowest of which is a thrust bearing. Both halves of the elevator are supported in four bearings each. All tail surfaces are built up from extruded aluminium-alloy profiles and from sheet. Rudder aerodynamic compensation amounts to 32 per cent chord; elevator and aileron compensation attains 29 per cent. Trimmers are electrically actuated but have an emergency manual control. A spring servo-compensator has been used on the rudder, relieving the pedals from excessive forces due to aerodynamic over-compensation. All control surfaces are mass-balanced units.

"The control system contains no boosters; all movable surfaces are actuated by pushrods."

NORTHROP NATO PROJECT

A DESIGN by Northrop, the N-156F, has been approved by the U.S. Government as a low-cost but high-performance fighter for use by America's smaller NATO allies. The aircraft, which is twin-engined (J85s with afterburners) and has been projected by the Northrop Corporation in parallel with the U.S.A.F. T-38 programme, will go into production soon and a first batch is expected to be available—presumably for sale—in the 1961-65 period. The N-156F project was briefly described in *Flight* for June 20, 1958.

JOHN DE HAVILLAND AWARD

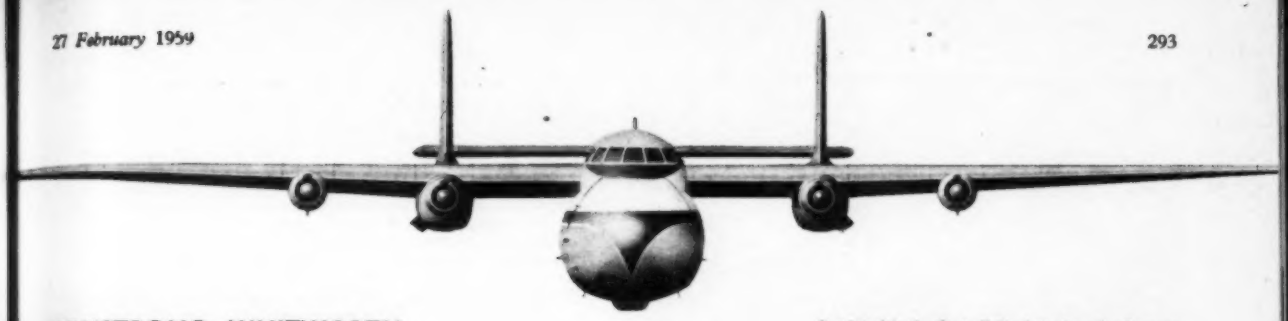
WHEN John de Havilland was killed on a test flight in 1943 a trust fund was set up in his memory by Sir Geoffrey and Lady de Havilland. Since 1945 this has been administered by the Society of British Aircraft Constructors, and until recently was used to assist boys wishing to take up apprenticeships in the industry but unable to do so without additional financial help. But over the last few years, economic conditions of training in the industry have changed, and for some time there have been no requests for help from the fund.

It is therefore being used for a new form of award, to develop powers of leadership by experience in any form which may help to widen a man's outlook, and is again to be administered by the S.B.A.C. The value of the award is £400; only one is tenable in any year; and candidates are invited to make their own proposals for the use of the money, such as for travel, academic training (at home or overseas), or technical, commercial or other experience (again either at home or overseas). The experience gained should be of benefit to a man working in the aircraft industry, though this may be widely interpreted.

Candidates should be between 18 and 25 years of age in the year of the award and will be judged on their record, merits and character and on the originality and resource of their proposed scheme and efficiency in presenting it, both in writing and also at an interview. Each holder will be required to make a monthly report on progress and (at the end of his period) a full report on what he has done and the experience gained. The first tenure must not start before August or September this year, and applications should be sent in not later than May 15 to the Society of British Aircraft Constructors Ltd., 29 King Street, St. James's, London, S.W.1.

FERRANTI A.T.C. SYSTEM?

FROM a recent personnel advertisement in *The Observer* it appears that the computer department of Ferranti Ltd. is preparing to enter the field of air traffic control. They call for logical designers, programmers and engineers for air traffic control and radar data-handling systems and also for electronic and mechanical engineers to work on high-density magnetic recording, analogue-to-digital conversion and other techniques for data-transmission systems. The Ferranti computer department, which is based at Bracknell, Berks, was not willing to amplify this information.

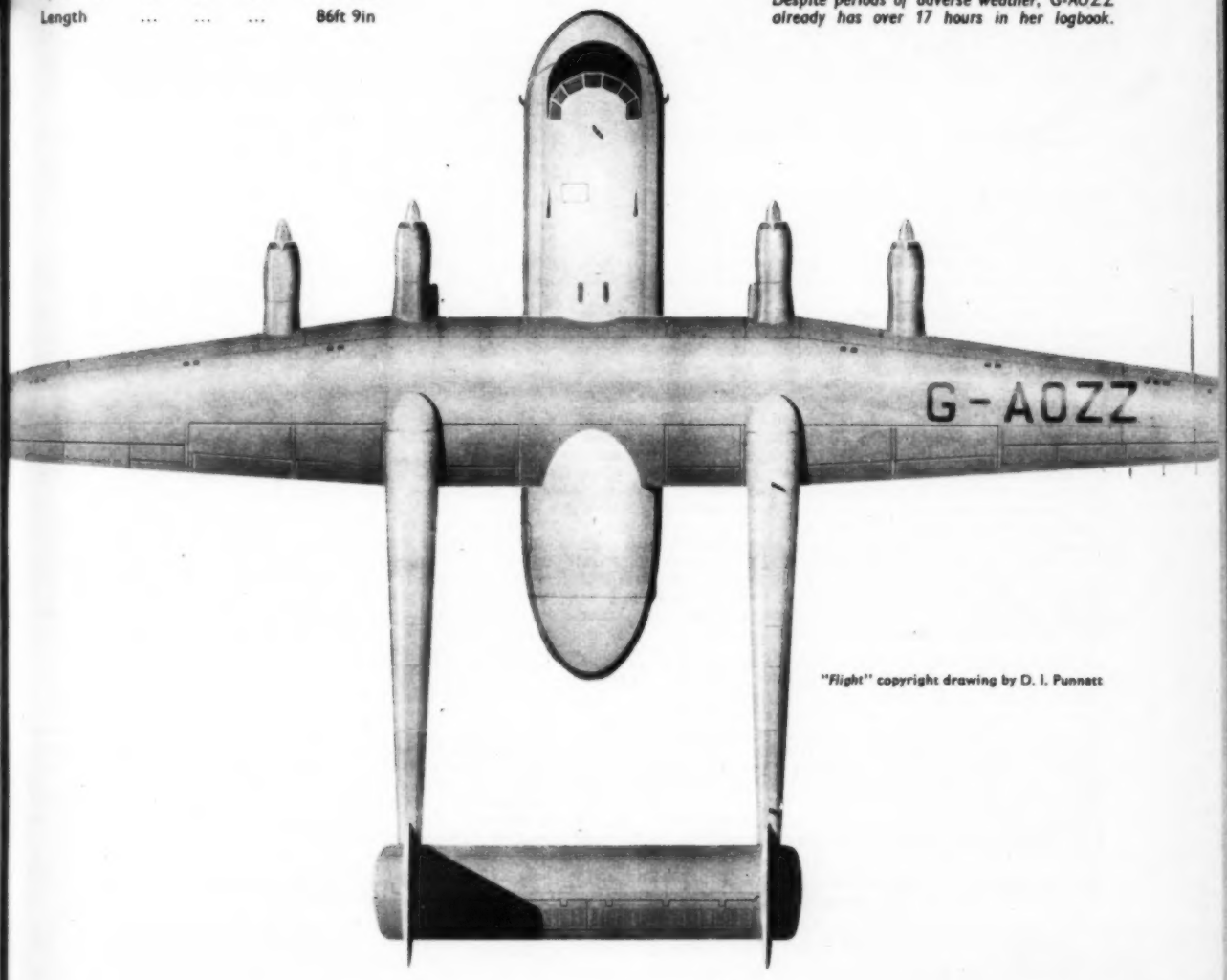


ARMSTRONG WHITWORTH AW.650 ARGOSY

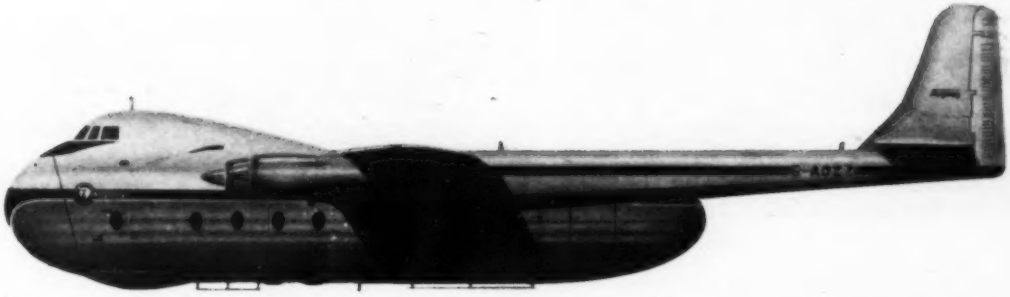
(Four Rolls-Royce Dart 526)

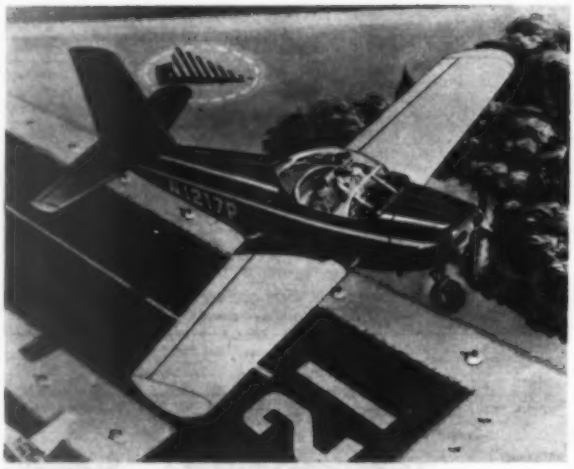
Span	115ft
Length	86ft 9in

Depicted is the first of the Argosies, the demonstrator G-AOZZ. The fuselage has a white top and there are dark-blue flashes along the fuselage and tail booms. Forward of the cockpit is a dark-blue anti-glare crescent. The name and company insignia on the nose are in white. Despite periods of adverse weather, G-AOZZ already has over 17 hours in her logbook.



"*Flight*" copyright drawing by D. I. Punnett





The Piper Papoose, subject of this artist's impression, is currently undergoing preliminary design study and market evaluation. The proposed two-seater would cost $4-5,000 and would be powered by an engine in the 90-100 h.p. range

Sport and Business

SURREY AND KENT FLYING CLUB is the new name of the Surrey Flying Club, following its move earlier this month from Croydon to Biggin Hill. At its new base the club is responsible for fire and emergency services as well as air traffic control and, together with the smaller flying groups previously at Croydon, occupies one-half of the hangar and all the offices previously used by No. 615 (R.Aux.A.F.) Sqn.

The move to Biggin has involved a marked expansion of accommodation and responsibility for the Surrey club, which will now employ its own ground engineers to carry out maintenance of light aircraft based at Biggin. As already briefly reported, the main transfer began on the morning of Sunday, February 8, when two large lorries were loaded with club furniture and equipment at Croydon. As C.F.I. Peter Chinn was demonstrating his firelighting abilities on the many stoves in the club's offices at Biggin, instructor Tiny Marshall, having supervised the lorry-loading, hung a new sign outside the old Croydon clubhouse which read "TO LET. APPLY WATKINSON, LONDON, W.1." Bad weather prevented the aircraft from flying over the same day.

Being forced to leave their base and start again elsewhere is no new experience for the Surrey club, who started from scratch at Croydon in 1954 after Redhill Flying Club had disbanded. On that occasion the move involved re-forming the club and literally building a new clubhouse; the more recent change to Biggin had at least the advantage of being a simpler and easier move into ample existing accommodation.

AN INTERNATIONAL AIR RALLY at Jersey is again to be organized this year by the Channel Islands Aero Club. This was decided at the recent annual general meeting of the club. As in previous years, the date of the rally will coincide with the anniversary of the Island's liberation from German occupation in 1945, which this year is the weekend of May 8-10. The programme will include a dinner, social evening and tour of the island, and the R.A.F. is again to be asked to provide an escort for aircraft not fitted with radio.

During the meeting the honorary secretary, W/C. M. E. Pickford, reported that membership had increased during the year from 270 to 300, of whom 50 were flying members. Officials elected at the a.g.m. were R. Jenkinson, chairman; P. Hopkins, vice-chairman; E. C. Marshall, hon. treasurer; W/C. M. E. Pickford, hon. secretary; committee: R. W. Spears, W. Hallworth, E. Lannoy, S. Woolmer, R. Le Sueur and R. Bryant.

AFTER 23 YEARS' SERVICE as secretary of Northamptonshire Aero Club, Mr. W. Parry recently resigned from this post. He had also been catering manager of No. 6 E.F.T.S., the R.A.F.V.R. and the R.A.F. Basic Flying Training Schools during their existences at Sywell. A testimonial fund for Mr. Parry from past and present club members and instructors and pupils of the R.A.F. training schools has now been established by the club.

WEDNESDAY EVENINGS at the Kronfeld Club, beginning March 4, will be devoted to a five-week series of pre-soaring season talks. The subjects will be air law and airways (H. C. N. Goodhart), navigation (Lorne Welch), instrumentation and cloud flying (David Ince), soaring and cross-country flying (Tony Goodhart), and field landings and retrieving (Lorne Welch).

AT THE INAUGURAL MEETING of the Home Counties Branch of the Glider Pilot Regimental Association in Oxford earlier this month, the honorary secretary, Mr. A. Procter, said that one of the objects of the branch was to form a gliding club. The club would be affiliated to the Windrushers Club at Bicester R.A.F. Station, and it was hoped to raise a loan for the purchase of a glider.

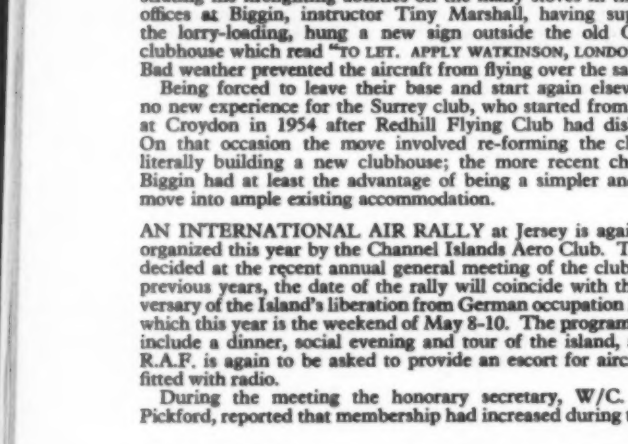
ONE OF THE FIRST MACHINES from the Piaggio P.166 production line has been bought by Sir Robert McAlpine & Sons Ltd. Production deliveries of the six-seater amphibian should begin next month, and the British machine will be registered G-APSJ and will be based at Luton Airport, where the McAlpine company's Aviation Division is managed by Capt. Raymond Young. List price of the P.166, with full instrumentation and finished as a luxury six-seater with toilet and bar, is £28,735.

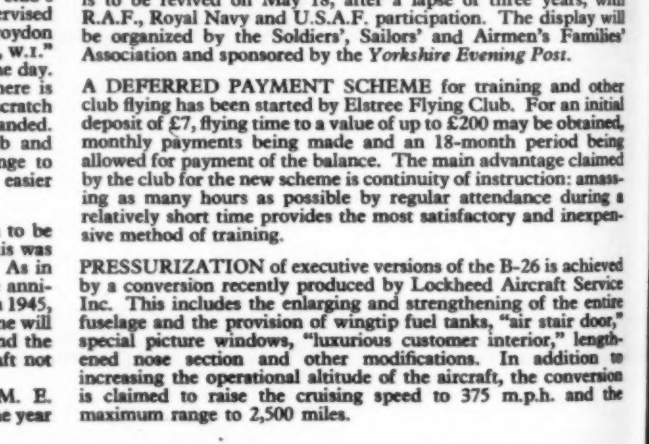
THE WHIT MONDAY AIR DISPLAY at Yeadon Aerodrome is to be revived on May 18, after a lapse of three years, with R.A.F., Royal Navy and U.S.A.F. participation. The display will be organized by the Soldiers', Sailors' and Airmen's Families' Association and sponsored by the *Yorkshire Evening Post*.

A DEFERRED PAYMENT SCHEME for training and other club flying has been started by Elstree Flying Club. For an initial deposit of £7, flying time to a value of up to £200 may be obtained, monthly payments being made and an 18-month period being allowed for payment of the balance. The main advantage claimed by the club for the new scheme is continuity of instruction: amassing as many hours as possible by regular attendance during a relatively short time provides the most satisfactory and inexpensive method of training.

PRESSURIZATION of executive versions of the B-26 is achieved by a conversion recently produced by Lockheed Aircraft Service Inc. This includes the enlarging and strengthening of the entire fuselage and the provision of wingtip fuel tanks, "air stair door," special picture windows, "luxurious customer interior," lengthened nose section and other modifications. In addition to increasing the operational altitude of the aircraft, the conversion is claimed to raise the cruising speed to 375 m.p.h. and the maximum range to 2,500 miles.

The new registration markings of Kuwait are seen on the aircraft below. On the left is an Aiglet Trainer, previously G-ANXX; on the right, a Dove 6, previously G-AOUH. Both machines belong to the Kuwait Flying Club





Straight and Level

THAT aeronautical iconoclast Lord de Bunkingham is at it again. The object of this youthful peer's latest slashing attack is the Society of British Plane Makers.

Writing in the highbrow aviation quarterly *British Imperial Air Power Gazette*, his provocative pen gushes a torrent of challenging criticism which will rock the S.B.P.M.—hitherto as unassailable as the Monarchy—to its foundations.

"Why," his lordship asks, "does the S.B.P.M. hold its annual display only once a year? The show is over before anyone has time to appreciate it. I have sometimes seen members' caravans and exhibition stands so full of foreign visitors and customers that key executives have no time to spare for the real purpose of the show—namely, the entertainment of colleagues and Ministry of Planes officials (who are, after all, paying for the show); no time for the appreciation of the company's latest glamour brochures, produced at such expense; and no time to watch the thrill-packed flying over a gin and tonic or a cup of tea. . . ."

Of course, Lord de Bunkingham is a professional controversialist, and we need not take too much notice of what he says. And those S.B.P.M. firms who are now planning their contribution this year can utterly reject his suggestion that one whole day of the display should be set aside for foreign customers.

● Fokker have discovered an appropriate and original theme for a new F-27 advertisement: the anniversary of the publication by the Dutch lawyer Hugo Grotius of his classic treatise on the freedom of the air. Grotius developed his arguments some 300 years before Kitty Hawk, and at that time there seemed little reason to refute his theme that passage through the air should be as free as passage across the oceans. But two subsequent world wars have left him with few supporters.

The Dutch are one of the very few champions of freedom of the air. Unlike most other countries, the Netherlands have had little to lose and everything to gain by being liberal. For this reason they were particularly upset by the reduction of K.L.M.'s traffic rights at Singapore. No moment could have been more opportune for release of the Grotius advertisement.

Although this sales ploy was perfectly calculated to take advantage of the growing European awareness of the penalties to be paid for restrictionism, the wording of the ad. is cleverly devised to avoid causing offence to potential customers from the nationalist school.

● I have just realized that North American are working on four aircraft with all-inertial navigation systems: the A3J, B-70, F-108 and X-15.

As far as I can determine, this is three more than anybody else, and is another feather in the cap of the first firm in the West to fly such systems (very subsonically in a C-47 and very supersonically in X-10s and G-26s).

Someone suggests that I challenge the French claim that they operated the world's first commercial air service—on February 8, 1919, when a Farman Goliath flew 11 passengers from Paris to London. The British say that this was a semi-military flight, and that the world's first *truly* commercial scheduled service was on August 25, 1919, when a D.H.4A of Aircraft Transport and Travel flew two passengers and some grouse from London to Paris. But I hesitate to challenge our ally's claim: Air France gave such a nice celebration party, and they issued delightful pictures—for example this one—to mark the anniversary

● "At this time the Comet is recognized as the aeroplane for the operation of which most money should be paid to pilots," writes an influential pilot. "The Comet," he goes on to say, "is the aircraft in B.O.A.C. with the best potential productivity . . . It is therefore fair and reasonable to expect that an increase in productivity should produce benefits which, in part, should be passed on [my italics coming up] *to those responsible for the increase . . .*"

Steady on! It *is* fair and reasonable that higher productivity be rewarded with higher pay. But it is not the pilots who are responsible for their own increased productivity; it is management, because they have bought more productive tools for the pilots to operate.

If the pilots want more pay (and who doesn't?), they must accept the principle that higher-productivity tools bring redundancy, *unless* traffic expands to restore the number of higher-productivity aircraft in the fleet. Traffic won't expand unless fares come down, and fares won't come down if the potentially lower costs of the new, more productive aircraft are vitiated by higher crew-costs.

As for the argument that the pilots of the new aircraft should have higher pay *and* a third pilot in the cockpit—*negative!*

● A much less vulnerable case for increased pilot pay is the increased individual responsibility which, it can be argued, the newer aircraft bring.

And talking about pilot-responsibility in general—whatever type of aircraft is concerned—I think a quote from *The Log*, the journal of the British Air Line Pilots Association, is very much to the point. A contributor does not see "why terms such as designer error, engineer error, operator error, management error, etc., should not be as familiar as the hoary old . . ."

No need for me to quote the last two words.

● Everybody in the aircraft-electrics game tells me that the promising idea of a D.C. starter/generator has not been borne out in practice. In fact it appears that an efficient and reliable starter/generator simply cannot be made.

May I then commend any of my readers who happen to be familiar with shunts and star-delta windings to take a look at Mr. Oleg K. Antonov's big An-10 transport (pages 289-292, this issue)?

It appears that his boys in Kiev are cleverer than we are; especially since—so far as I am aware—the NK-4 and AI-20 turboprops which power the An-10 are single-shaft engines, which need far bigger starting loads than a modern two-spooler.

● The *Sunday Times* for February 15 said that out of 1,000 design staff employed by a certain British aircraft firm only 15 earned as much as £1,500 to £2,000 a year.

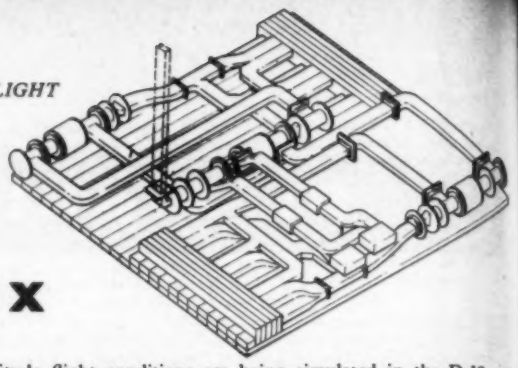
In the same issue—even on the same page—in the "appointments" columns, an industrial firm making process machines offers £2,000 plus bonus, plus car, to a sales manager aged 30-40. Another concern offers a packing manager £1,500. A third firm offers a salesman, 25-35, up to £2,600 plus commission, plus car allowance.

But—we must tell our sons—it is a *privilege* to work in the aircraft industry.

● I am now able to offer the obvious answer to the Vortac (U.S.) versus Decca (U.K.) air navigation controversy.

To ensure that Decca wins, should we not persuade the Russians to support the American Vortac system?

ROGER BACON



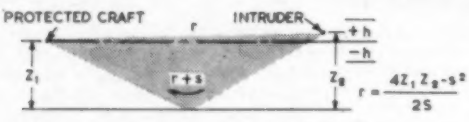
Left, the drift and groundspeed indicator of the Bendix Doppler and, right, the duplicated, fixed planar array of the slotted-waveguide aerial

NEW FROM BENDIX

IN a new approach to European markets, Bendix Aviation Corp. have recently brought technicians and equipment to various centres in Europe for a series of demonstrations and lectures. For three days in Paris earlier this month, 32 technicians from the 26 Bendix divisions gave lectures and demonstrations to 800 invited guests from 16 countries and showed six tons of equipment shipped specially from America. Every kind of Bendix product was featured, and the following brief descriptions cover certain of the new radio and radar items.

The principal airborne radar equipment was the DRA-12 Doppler which was first flown in a Beech D-18 during the time of the Paris meeting. During design, Bendix used a computer to analyse all the factors affecting the performance of pulse, CW and FM/CW systems and came to the conclusion that a typical FM/CW system would have 3db better performance than a theoretically CW system and 20db better than pulse. The aerial system is entirely fixed and mounted rigidly to the airframe. It consists of two planar slotted-waveguide arrays each measuring 26in by 13in which may be mounted side-by-side or end-to-end behind a dielectric panel in the skin. The assembly is very shallow, having a maximum depth of only 3.1in, but the fixed mounting has probably been adopted to avoid the much larger volume required if the whole aerial had been movable. Switching between the two halves of the aerial, or between two receiver/transmitters of a duplicated system using the same aerial, is accomplished by ferrite switches containing no moving parts.

A frequency-modulation signal at 8,800 Mc/s is directed through the aerial to project the four 3.5 deg-wide beams of the janus system in rotation ten times per second. Returned signals are diverted by a circulator and, through various stages, passed to



Method of calculating range from direct and ground-reflected signals related to barometric height indications

the tracker as a remodulated signal at 500 kc/s with the lower sideband removed. Four tracker elements each contain an oscillator servoed electronically to match the centre of the relevant Doppler spectrum.

The four resulting oscillator frequencies are fed into a combiner from which combinations representing aircraft velocity components along and across track and vertical velocity are derived.

The values are fed to the computer which derives groundspeed entirely by digital processes without the need for attitude information derived from gyros. Drift calculations use digital and analogue circuitry with attitude information from a vertical gyro. Output is in the form of an analogue voltage and a tangent potentiometer. A differential synchro modifies heading information for use in the navigation computer. Attitude signals need only be accurate to within ± 1 deg.

A test circuit feeds a sample signal into the system so that all but the aerial can be checked in flight against the failure-warning flag and known sample drift and groundspeed indications. The computer for groundspeed and drift contains about 2,000 components, 90 per cent of which are ¼W resistors and ceramic capacitors. Mean time between failures should be at least 1,000 hr. Of the 350 transistors used in the whole equipment, some 200 are in the computer and Bendix estimate a failure probability of one in 40,000 hr.

Airline evaluation models of the DRA-12 should become available in May and production equipment in the autumn. The system is designed to operate best ("optimized") at 600 kt. High-altitude flight conditions are being simulated in the D-18 test aircraft by introducing attenuations in the transmitter output—a technique which has given trouble in trials of other Dopplers. A land/sea sensitivity switch is incorporated and Bendix claim that the equipment has continued to function with attenuation values of 30 db. Maximum attenuation from land to very calm water on Chesapeake Bay was measured at 15 db. Bendix say that the DRA-12 provides at least 12 db margin under the worst conditions before signal is lost and that an attenuation factor of 6 db per octave of increased altitude will allow operation at over 98,000ft with a 6 db margin.

Aircraft pitch limits are given as between ± 12 and 20 deg, depending on speed, height and terrain. Roll limits will be determined by height and terrain and maximum drift angle is 40 deg. Transmission power is ¼W. Design is to ARINC specification 540 and the weight of single and dual systems are respectively 59.5 and 100.3 lb without cables or mountings.

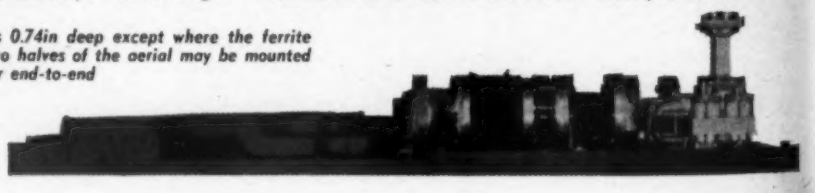
Bendix is one of the many companies which have worked on collision-avoidance systems during recent years. Many ran into apparently insoluble technical difficulties and ceased work. Bendix held a military contract to develop a system and this was subsequently transferred to Airways Modernization Board and then to F.A.A. authority. Development has now reached the stage where Bendix hope to make flight-tests during the next few months to prove the feasibility of the principle they have chosen.

Early exhaustive studies showed that a collision-avoidance system must be co-operative to function, though sufficient protection might be achieved even when only certain classes of aircraft participated. The system is based on a conventional pulsed-oscillator transmitter operating at 450 Mc/s with peak power of 1kW and a pulse width of 0.5 microsec. Each aircraft transmits a burst of pulses in which the inter-pulse time is proportional to the aircraft's height derived from its barometric altimeter. The receiver in another aircraft is gated so that it accepts only those signals radiated from other aircraft in the same height band. Range between the two is derived by measuring the time interval between reception of leading edges of directly received and ground-reflected pulses, combined with height indications. Successive range measurements taken during, say, four pulse bursts provide an indication of rate of closure from which the time to theoretical nearest approach of the intruder can be assessed, assuming that collision courses are being flown. If the computed time is less than an arbitrary time of, say, 30 or 45 sec, an escape manœuvre is ordered. Bendix estimate that vertical escape manœuvres are most effective and the escape command would therefore be adjusted according to the relative barometric heights of the two aircraft. In addition, any aircraft in the protected height band which comes within, say, one or five miles will in any case initiate a call for escape.

In order to accommodate a large number of aircraft in the system, each transmitter will be inhibited for 10 sec between bursts of pulses. It is estimated that the complete airborne equipment could fit into a 1 ATR case with normal weight and power supply for this size. A minimum station for light aircraft, having only transmitter and timer portions, could fit into a ½ ATR case.

Bendix have proposed a method of obtaining range measurement from normal communications signals. In this system, an oscillator in the interrogating station briefly modulates a normal V.H.F. transmission, the frequency and phase of which are detected and retained in a memory circuit in the receiving station and returned to the interrogator as a modulation of the next transmission. Detection of the phase shift in out and return propagation at the interrogator station will derive a distance measurement. Tuning forks are used to stabilize both interrogator and memory oscillators. To avoid phase shift of more than 360 deg, the modulation frequency must not exceed 809.2 c/s for a maximum range of 100 miles. Accuracy obtainable is 2 per cent of maximum range and the additional circuitry to be added to a standard communications radio fits in a short ½ ATR case.

A side-view of the DRA-12 aerial. It is 0.74in deep except where the ferrite switches increase depth to 3.1in. The two halves of the aerial may be mounted side-by-side or end-to-end



THE INDUSTRY

Napier in Canada

A CANADIAN subsidiary has been formed by D. Napier & Son Ltd. to deal with its increasing trade from that country. The new company's title is D. Napier & Son (Canada) Ltd. and its head office is at 4104 St. Catherine Street West, Montreal (telephone Wellington 7-9383). The Board of directors is as follows: H. Sammons, C.B.E., M.I.Mech.E., F.R.Ae.S. (managing director of D. Napier & Son Ltd.), president; L. A. Sanson (formerly Napier's senior representative in Canada), executive vice-president; S. M. Finlayson (president, Canadian Marconi Co.), director; J. C. K. Shipp, B.Sc., A.F.R.Ae.S., M.I.Ae.S. (vice-president, Napier Engines Inc., U.S.A.), director; and H. B. Style, A.M.I.E.E. (president, John Inglis Co. Ltd., Toronto), director.

The staff of the new company will include Mr. F. W. Donaldson, as marine and industrial representative; and Mr. G. T. R. Cochrane, who as aero representative will be responsible for handling matters arising from the installation of the Eland in civil and military versions of the Canadair 540, with the conversion of piston-engined Convairs to Elands, with civil and military applications of helicopter gas turbines, with rocket engines and with Napier Spraymat.

Napier is a member of the English Electric group of companies, which already has extensive interests in Canada through its links with John Inglis Co. Ltd. and the Canadian Marconi Co.

Warm Air on Tap

ILLUSTRATED below is the Atlas Copco Air Partner Type M-3, ten of which have been purchased by S.A.S. to service their DC-8 fleet. The vehicle can be used for starting all aircraft incorporating air-turbine starters and for air-conditioning, de-icing and checking pressure systems.

The unit makes use of the Atlas Copco rotary-screw compressor, which operates on the now well-known system evolved 25 years ago by the Swedish engineer Lysholm. The Air Partner is available in two models. The M-3 unit consists of two compressors, both driven from a petrol engine by a built-in gear and centrifugal coupling. A second model, the M-2, has a single compressor and is designed for limited air-conditioning and for air-turbine starting. In each case the compressors are of the single-stage water-cooled type designed for continuous running.

Optimum efficiency is obtained by running the compressor at a fairly moderate speed, and this is taken care of by a regulating system. Its primary function is to adjust the output of the ground unit to the changing demands of the aircraft equipment, and in particular to the requirements of the various pneumatically driven auxiliaries. The prime mover has two idling speeds: a low setting for warming up and checking, and a high setting for the stand-by position. Acceleration time from stand-by to full output is stated to be generally less than that for present-day gas turbines.

From stand-by to the maximum shaft-speed setting, the torque is fairly even and gives constant acceleration. As the compressor airflow varies directly with the r.p.m., the fall in pressure when the air valve is opened is negligible. The regulating system depends on the use of two governors, one for pressure and the other for flow. The pneumatically operated pressure-governor is manually preset according to service requirements, and the airflow-governor is adjusted to consumption by speed-governing the motor.

When used for starting, the Air Partner delivers through a hose to the aircraft a continuous flow of warm, oil-free air for the turbine starter. The air—which is heated by the compression process—is maintained at a temperature high enough to provide good starting, yet never so high as to endanger the interior ducting of the aircraft. The unit is capable of turning over the aircraft engine continuously, thus allowing pressure checks and blowing-out operations.

Conversion of the Air Partner from a starter to a ground-air conditioning unit is merely a matter of flicking over the appropriate switches and pressing a button. In less than an hour, state the makers, it can warm up both passenger cabin and flight deck from well below freezing point to normal "comfort" temperature or, in tropical conditions, cool the interior to a corresponding degree.

For de-icing, a special applicator is fitted to the hose so that the aircraft wings and fuselage can be "air-sprayed" by hand. Where the aircraft has an internal hot-air de-icing system, removal of ice and snow from windscreens, wing leading edges and air intake lips is achieved by coupling the hose to the aircraft installation.

With the addition of an auxiliary circuit and controls, the Air Partner can be used for cabin pressurization checks.

It is stated that the noise from the compressor units is "comfortably low and not objectionable," and that the normal overhaul period for the compressor is 10,000 hr; maintenance can be carried out by airline personnel anywhere in the world. Auxiliary equipment of the vehicle includes a CO_2 fire extinguisher, radio noise-suppression equipment and obstruction warning lights.

The Air Partner is handled in this country by Atlas Copco (Great Britain) Ltd., Beresford Avenue, Wembley, Middx.

Four of the directors of Napier's new Canadian subsidiary: Messrs. Sammons, Sanson, Finlayson and Shipp (see col. 1)

IN BRIEF

Viscount Hailsham, Q.C., Lord President of the Council, is to deliver the opening address at the International Convention on Transistors and associated semiconductor devices which is to be held at Earls Court, London, from May 21 to 27.

* * *

The offices of the Aviation Division of the Goodyear Tyre & Rubber Co. (Great Britain) Ltd. have been transferred from Bushbury, Wolverhampton, to more spacious premises at 8-9 Salop Street, Wolverhampton (telephone: Wolverhampton 27727).

* * *

Mr. Geoffrey Howard Edmunds, 28-year-old assistant to the aircraft group accountant of the Plessey Co. Ltd., has been awarded the Donald L. Moran Prize for his paper on *Management (Factory and Distribution)* by the Institute of Cost and Works Accountants.

* * *

Technivision Ltd. have moved their studio and offices to Braywick House, an old country mansion on the Maidenhead - Windsor road, three-quarters of a mile from Maidenhead station. They are retaining their London office at 51 Brompton Road, Knightsbridge, S.W.3.

* * *

Under an arrangement between Davis & Timmins Ltd. and Wade Couplings Ltd., the former have been appointed distributors and stockists of the Wade range of compression pipe couplings. The companies state that existing sales arrangements will not be disturbed but "it is hoped that the availability of local stocks at the Davis and Timmins depots throughout the country will prove to be an added advantage to users."

* * *

Mr. R. W. Stobbs, F.R.I.C., F.I.M., has been appointed general manager of Preformations Ltd., the company recently set up at Swindon by the Plessey Co. Ltd. and the Arnold Engineering Co. of Illinois for the manufacture of Magloy permanent magnets. Mr. Stobbs joined Plessey five years ago as principal metallurgist at the company's Ilford factory, having previously been with David Brown Industries Ltd. as chief research metallurgist of their foundry division and prior to that with the Ford Motor Co. Ltd.

Rear and front views of the M-3 Atlas Copco Air Partner described above

Programme-controlled Altitude Chamber

Complete Flight-plans Simulated in D.H. Propellers' New Test Facility

By P. R. PRIOR*

Interior of the chamber

MOST manufacturers of aircraft accessories are finding it increasingly essential to be able to simulate on the ground conditions appropriate to flight at high speeds and high altitudes. As manufacturers of major air-conditioning components, de Havilland Propellers Ltd. have spent a considerable sum on an advanced altitude chamber in which any desired condition can be achieved, with the individual parameters separately variable by an automatic control system. D.H. Propellers delegated to Honeywell Controls Ltd. the responsibility for the design and development of an automatic control system which can automatically simulate a complete mission. Pneumatic control was chosen for fast response.

After nine months of co-operation between the two companies the chamber was built and tested. Careful dovetailing of chamber results with those obtained in flight established the validity of the method.

From this stage progress was rapid. Shortcomings of prototype equipment were quickly detected. The air-conditioning unit for one aircraft, for instance, had passed all its official sea-level and altitude tests at quite severe and apparently representative conditions when unexpectedly great difficulties arose in service. Under the representative conditions produced by the altitude plant it was found that the original tests had failed to show certain shortcomings which were now immediately apparent. A rapid programme, checked at every stage by reproducing identical flight conditions, established within a very short time where the fault lay and showed the design team exactly which of their moves would have the greatest effect. Following final remedial action no further trouble was encountered. It was clear that a test facility had been created in which research data could be compiled more cheaply, more conveniently, and in many cases more accurately, than in an aircraft during flight.

Consisting of seven sets of programme controllers, the control system regulates the seven most important variables affecting air-conditioning units during flight. On each controller a pointer indicating the required value for the variable bears upon the profile of a programming disc, the contours of which cause the pointer to move in accordance with a predetermined flight plan. The controller interprets these movements of the pointer and changes the variable accordingly. The addition of derivative action to some of the controllers provides a system of control which is in theory infinitely flexible and which can call for rates of change as high as any of those that can be expected to occur in actual flight. In practice the severity of the conditions is limited only by the power available.

Variables Controlled. The behaviour of aircraft air-conditioning systems depends, of course, largely on speed and altitude, engine setting and ambient temperature and humidity. In the test plant the seven most important variables are regulated and synchronized by the programme control system. Two of the controllers govern the temperature and pressure of the air simulating the cabin supply tapped from the engine compressors; two regulate the air supplied to the secondary circuit; and the remaining three control the independent altitude pressures—cabin altitude, secondary-circuit discharge and ambient altitude.

The controllers regulate conditions in the 1,500 cu ft chamber by calling upon four sources of power—a high-pressure air supply operating up to 220 lb/sq in abs; a medium-pressure air supply at 110 lb/sq in abs; heating and cooling capacity sufficient to produce air-supply temperatures ranging from −50 to +350 deg C; and an extraction plant to simulate altitudes to 80,000ft.

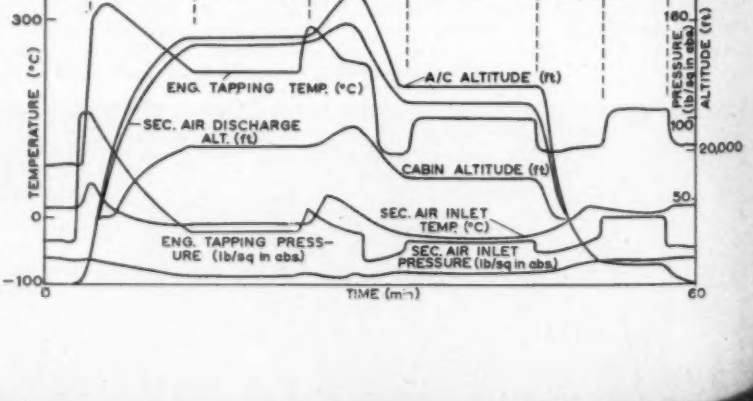
Pressure Control. The high-pressure supply is led from the compressors through a control valve, heat exchanger and electric pyro-bar heater into the chamber, where it is connected to the system under test. Temperature and pressure pick-ups are installed at the appropriate points and the measurements taken are continuously transmitted to the controllers concerned. As already briefly explained, the existing pressure at any moment is indicated by a recording needle, the position of which coincides with the position of a second needle that follows the profile of the programming disc; and the controller, sensing any difference that may occur between desired and measured values, changes the pressure at the required rate by closing or opening the supply pressure control valve. The recording needle continues to record instantaneous system-pressures, and the completed chart confirms the accuracy of control obtained. In this way, the supply pressure to the system is altered at the required rate and the correct system-pressure is maintained at any instant. The medium-pressure air supply operates on a similar principle.

Temperature Control. The programme controllers for temperature operate a series of pneumatic switches. If, for example, the supply heaters are full on when a drop in temperature is called for by the controllers, the pneumatic output from the latter increases. This gradually releases the pneumatic sequence-switches and successive heater bars are taken out of circuit. By the time the controller's pneumatic output has reached half its maximum value all the heater bars are off. If this is not adequate to produce the required rate of fall, the control pressure rises further. As this occurs, an increasing quantity of pre-cooled high-pressure air is supplied to a slave refrigeration unit serving the heat exchanger in the main supply circuit. Forced cooling is thus supplied to the circuit until the demands of the programme are satisfied. Sufficient reserve is available for temperature-changes as rapid as any that could be expected to occur in flight.

Altitude Control. The controllers for altitude operate diaphragm valves situated in pipes between the chamber and a second damping tank. This tank is maintained at a certain ceiling altitude, which is always above that required for any of the test circuits. The controllers merely interpose pressure-drops between the main-chamber control-points and the damping tank, thus ensuring that the programmed altitude is always maintained.

The whole programming cycle can be "frozen" at any instant, in which case the controllers continue to maintain the existing set of conditions. The response of each controller can be modulated by means of variable proportional and integral action, and the whole cycle can be slowed down to operate at any required speed.

*Honeywell Controls Ltd.



Typical graph of system conditions for a given flight plan. Fed with this information, the controllers cause the complete flight to be simulated in the altitude chamber

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

K.L.M. and Singapore

WHILST second to none in my admiration of K.L.M. (my association with Royal Dutch Airlines goes back to 1933, in Baghdad) and as one who had, and has, great respect and affection for the late Dr. Albert Plesman—who did so very much for global aviation, whilst striving perpetually for the peace of the world—I cannot but marvel at the apparent naïvety of your correspondent, Mr. B. van der Klaauw [February 13] in his approach to the matter of K.L.M.'s traffic rights at Singapore. At the same time one regrets some of his implications in regard to B.O.A.C.

Surely the exchange between nations of passenger and cargo traffic rights is now a matter of plain commercial "horse-trading." What is wrong, in the struggle for economic airline operation, in not giving away more than you receive?

Thanks to careful planning and preparations, K.L.M. got away to a flying start after the last war—with the newest of American equipment. It became an airline dependent to a very large extent on the traffic of countries other than the Netherlands, a situation aggravated by the emergence of Indonesia. K.L.M. is in fact—and good luck to it—an airline which has not cut its suit according to its own cloth, and it now battles not only to retain traffic rights already acquired—and sometimes only on a temporary basis—but also to grasp more rights, offering nothing of equal value in exchange.

To allege that the expansion of K.L.M. is thwarted by political considerations is strange in this context. Has not the airline extended its activities by just that means?

London, W.1. MAX STUART-SHAW.

Airliner Crewing Policy

I HAVE been taking *Flight* now for 24 years and am aware of the sound judgment and commonsense between its covers. But for me, as a practising flight engineer, the peak was reached in Part 1 of J. M. Ramsden's article "Eastern Routes Jet" [February 13].

As an outsider he summed up the "third man" controversy well. The flight engineer has neither the means nor the desire to blow his own trumpet, and comments such as Mr. Ramsden's are invaluable if reason is to prevail.

The actions of B.A.L.P.A. have left a sour taste in the mouths of many of us in the aviation world. It is unfortunate that B.E.A. will have to operate their Comets with a pilot in place of the specialist, but I suspect the reason for this is due to the shortage of flight engineers as well as going a long way to solving the unfortunate problem of pilot redundancy.

However, now that the dust is settling, the flight engineer will be as grateful as anyone when this period slips into past history.

St. Albans, Herts. R. L. BARNARD.

Airline Safety

IN a leading article for February 13 you state ". . . the public . . . will never accept a system of transport which fails to exploit every means of enhancing safety as well as speed." If you mean this in its fullest sense, while being sympathetic with your underlying sentiment I cannot wholly agree. For, if the public has accepted air travel as a system of transport, this would imply that already it exploits every means of enhancing safety, and this is scarcely the case. For example, backward-facing seats would enhance safety, yet they have not been accepted because of adverse public opinion! Leading on from here, may I make the following observations?

(1) Safety often carries a weight penalty and therefore the incorporation of enhanced safety may be at the expense of payload, performance or comfort.

(2) Airlines would be unwilling to accept a loss in payload.

(3) In fact, the public is finally influenced more by performance and comfort than by safety. (Is this because performance and comfort are more easily measurable than safety?)

(4) A chain exists in which the designer is satisfying his employers and they, the aircraft manufacturers, gear themselves to airlines who, in turn, please the customer, the fare-paying passenger.

Designers, manufacturers and operators may recognize their responsibilities but dare not break the chain and face bankruptcy. It would appear that only through such bodies as I.A.T.A. or national governments could a co-ordinated drive for extra safety be made, for I cannot imagine the public being goaded into making an outcry for a small percentage increase in safety without being scared away from air travel altogether. In fact, is "education" of the public possible at all? Some even appear to regard backward-facing seats as a symbol of danger rather than added safety (!)—and here there is no weight penalty. Who is going to "sell" them an aeroplane with sophisticated safety features, in competition with one with higher performance and comfort?

Are there figures available of any survey to determine the relative passenger-appeal of performance, comfort and safety?

Shepperton, Middx. R. MANNING.

[The difficulty of measuring "passenger appeal" has probably been a factor in preventing statistical analysis in this field.—Ed.]

Foundations of Ford

THERE are one or two inaccuracies in the article by George Lanning on the subject of Ford Aerodrome (in the February 6 issue of *Flight*) which I would like to correct.

In the first place, the Ford Motor Company were *not* the original tenants of the aerodrome. The late Dudley Watt and I leased a portion of it in 1929 and formed the Sussex Aero Club there early in that year.

We had moved down from Brooklands where Dudley Watt at the time had been building the DW-2, an interesting light biplane fitted with a Cirrus engine and with Warren bracing to the wings. It had been originally designed by Mr. W. Pearson, one-time designer to Hawker Aircraft, who was, I believe, responsible for the Hawker Horsley, an aircraft to which the DW-2 (on a much smaller scale) bore a marked resemblance.

Apart from the Flying Club, we also operated at Ford what I believe was one of the earliest "flying circuses"; certainly this was in operation years before the Sir Alan Cobham's concern. Our "fleet" of aircraft consisted of two DW-1s (specially hotted-up S.E.5s with distinctive Dudley Watt cowling), the DW-2, and three Le Rhone-engined Avros. The last three aircraft were used for (apart from flying displays) instruction and joy riding. The DW-2, although it did a considerable amount of flying, never obtained its full Certificate of Airworthiness. The only model was, I believe, broken up in 1932.

Apart from Dudley Watt and myself, the chief pilot of the Sussex Aero Club was W. A. Rollason, who had just left the Royal Air Force as one of its first sergeant pilots. Rollason went on later to form Rollason Aircraft Ltd. at Croydon, and I myself started the Wiltshire School of Flying Ltd. at High Post, Salisbury.

Ford Aerodrome at that time (1929) was very definitely known as "Ford Aerodrome, Yapton" and was never referred to while I was there as "Yapton Aerodrome." It was always my understanding that the Ford Motor Company took it over mainly *because* of the association of the name. Certainly in our day—which was well before the advent of Fords—there was no question of what the aerodrome was called.

J. E. DORAN-WEBB, S/L.
Thruxton, Hants. Managing Director, the Wiltshire School of Flying Ltd.

I AM sorry that Mr. Lanning should be so emphatic about the title of Ford Aerodrome—when he is so wrong. The original aerodrome was constructed by a battalion of the United States Army in the summer of 1918. It was intended to be used for the assembly and test of U.S.-built Handley Page O/400s and was very definitely named Ford Junction Aerodrome from the beginning.

A number of O/400s were in fact assembled here by the Americans, but they may have been constructed originally by an English company. Two of the original hangars are still in existence.

London, N.12. D. C. CLAYTON.

IN August 1928 I flew from the Ford Airport, Detroit, to Cleveland in about 1¾ hr. We flew at 2,000ft, keeping to the shore line of Lake Erie at an airspeed of 80 m.p.h. In those days there was no possibility of continuing the journey to New York by air, so I had to take the midnight train.

Liverpool, 1. STANLEY BLAKE REECE.

What is a Calamity?

AS a constant reader and supporter of *Flight* I feel I must protest at the exaggerated line taken regarding the Boeing 707 in your leading article for February 13. I hold no brief for the Americans, but it seems to me the description of the occurrence as a "calamity" savours more of tabloid headlines than the normal level of reporting in the "First Aeronautical Weekly in the World."

Obviously the consequences of the fault in the automatic pilot might easily have been catastrophic, and must have been if the dive had continued; but the fact that the aircraft and its occupants did survive is surely a tribute to the strength of the airframe, whatever one's views may be on the design philosophy of pods and high wing-loadings.

I think few people will disagree with the main point of the article, that designers in general would be far better employed

(Continued at foot of next page)

Two views of the hub, showing the centrifugal compressor and the air-supply tubes; the third photograph illustrates one of the tip-jets

A SIMPLE PRESSURE-JET HELICOPTER

Prototype by a British Firm

FOR several years it has been apparent that the tip-drive pressure-jet principle offers advantages both to the largest and to the smallest types of rotary-wing aircraft. In a project being undertaken as a private venture by Mercer Pneumatic Tools Ltd. of Bradford, Yorks, an ingenious "boot-strap" arrangement appears to facilitate the achievement of a mechanical system of extreme simplicity.

The principle of operation is as follows. A 2kW starter/generator is geared up to a centrifugal compressor which feeds air to pressure-jet nozzles at the tips of the blades. At suitable r.p.m. the starter/generator is disconnected and a clutch can be engaged so that, by a train of gears, the rotor can be made to drive the centrifugal impeller, the latter turning at about 8.5 times the rotor r.p.m. and in the opposite direction. The cycle is thereafter self-sustaining.

In the prototype the two rotor blades are fixed in the neutral position, but provision will later be made for incorporating collective and cyclic-pitch control. From the two outlet volutes of the compressor the air is supplied through large-diameter flexible tubes which are capable of accommodating the flapping motions of the blades. Fuel to the tip jets is fed into the rotor shaft by means of a stationary oil-submerged gland positioned inside the vertical housing, and thence along a pipe inside the leading edge of the blade. Ignition is accomplished by a Lucas coil, a distributor inside the vertical housing and a ducted cable passing down the blade trailing edges.

It is suggested that, since the high-speed compressor impeller is mounted co-axially with the rotor hub and in the same plane as the blades, it will create a favourable gyroscopic effect which should damp out pitching motion and reduce vibration. The system should also be self-regulating, since any variation in the fuel supply automatically results in a corresponding variation in the delivery of air. Mercer Pneumatic Tools consider that a stage of development has been reached at which the potentialities of the system can be assessed with some accuracy. In production it is expected that the powerplant (rotor, compressor and starter/generator) could be produced for under £600.

Mercer Pressure-Jet Helicopter

Rotor diameter, 25ft; rotor r.p.m., 500; estimated equivalent s.h.p., 60; estimated weight of power unit and rotor (excluding fuel and battery), 150/175 lb; compressor impeller diameter, 17in; compressor r.p.m., 4,000/4,250; maximum delivery, 1 lb/sec; pressure ratio, 1.5:1; fuel consumption, 10 gal/hr.

CORRESPONDENCE (continued from previous page)

improving the safety of aircraft than in just making them go faster. It seems to me that this applies more and more to "artificial" lift devices which are mechanically operated. The attitude appears to be that there is no need to reduce landing speeds; each new lift device is treated as excuse for chopping a bit off the wing area rather than the stalling speed.

This process has now reached its logical (or, to my way of thinking, illogical) conclusion with things like the Griffith supersonic project, which is virtually all artificial-lift device and no wing. Ask the pilot if he wants jet flaps, flap blowing, boundary-layer control or whatever these modern sky-hooks are called. While they are working they are wonderful, but when they pack in he likes to be able to look out of his office and see a nice large comforting chunk of wing, and the more area the better.

Surely the craze for gadgetry is getting out of hand. A pilot has already been quoted in your columns to the effect that designers would be better occupied in making their pets reliable rather than in installing warning devices to show when they aren't working (and warning devices to show when the warning devices aren't working).

So far has the science of flight developed that piloted aircraft are now flying which are so unstable that their normal operation is dependent on gyro-stabilizing devices; if these fail, Joe, just get out—if you can. Imagine it—engine functioning normally, all controls operating, yet out you go. I think I'll stick to Tiger Moths.

Tolworth, Surrey. T. N. SIMPSON.

[The *Shorter Oxford English Dictionary* defines calamity as: "The condition of grievous affliction or adversity; deep distress arising from some adverse circumstance or event; a grievous disaster or misfortune." We believe that our use of the word in connection with the Boeing 707 incident was warranted. Well over a hundred people were suddenly caused "deep distress arising from some adverse circumstance." *Flight's* high opinion of the technical merits of the Boeing 707 aircraft—frequently expressed in these columns—remains unaltered.—Ed.]

British Private Flying

HAVING read with keen interest the article by D. B. Brown [*Flight*, January 30], I feel he has missed some salient points which adversely affect private flying. They are matters in which the Royal Aero Club should set about effecting some favourable alteration for the long-term good of themselves and the private airmen who look to them.

First the R.Ae.C. should weed out from their own organization all possible elements connected with commercial flying (bus companies are not interested in promoting private motoring). Then they should use all available means to overcome two main bugbears: (1) The rating of hangar space purely by area is, for club and private aircraft, an anomaly and the loudest possible protest should be organized; (2) the fees and salaries for flying instructors for training to the point of Private Pilots' Licences should be properly resolved to Government educational expenditure. The time has gone by for ignoring the fact that elementary flying instruction is an educational need. If the arrangements for these two items could be revised, much of the worry of clubs and centres would be relieved. Also, the question of a good standard of instruction would sort itself out.

Hythe, Kent. F. W. THOMPSON.

FORTHCOMING EVENTS

Mar. 3. R.Ae.S. Astronautics and Guided Flight Section: Informal Discussion on Rocket Propulsion.
Mar. 4. R.Ae.S. Graduates and Students Section: a.g.m. and Film Show.
Mar. 5. R.Ae.S. (Main Lecture, at London Airport Branch): First Fairey Memorial Lecture, "Sir Richard Fairey—an appreciation," by G. W. Hall.
Mar. 6. Helicopter Association: "The Place of the Helicopter in a Modern Army," by Lt-Col. P. W. Mead.
Mar. 7. Helicopter Association (Regional Lecture, at Yeovil): "Helicopter Activities in the Royal Navy," by Lt-Cdr. J. S. Sproule.
Mar. 7. British Interplanetary Society: "Radio Communications with a Space Probe," by Dr. W. T. Blackband.
Mar. 10. R.Ae.S.: "Water and Ice in the Atmosphere," by R. F. Jones.
Mar. 10-17. I.F.A.L.P.A.: Annual Conference, Helsinki.
Mar. 12. R.Ae.S.: 12th Louis Blériot Lecture, "The Nord Griffon; and Turbo-ramjet Power," by M. l'Ing. Gen. ce l'Air Noël Daum.
Mar. 13. British Gliding Association Ball, London.
Mar. 13. Radar and Electronics Association (Student Section): "Radar Data Handling," by Dr. L. C. Payne.
Mar. 18. Aircraft Recognition Society: Film Show.
Mar. 19. R.Ae.S. Astronautics and Guided Flight Section: "Long Range Missiles," by E. C. Cornford.
June 12-21. Paris Aero Show.
Sept. 7-13. S.B.A.C. Display and Exhibition, Farnborough.

R.Ae.S. Branch Fixtures (to Mar. 6): Mar. 2, *Derby*, "Methods of Propulsion in Space," by Dr. L. R. Shepherd; *Henlow*, "Beating the Heat Barrier," by J. Taylor. Mar. 3, *Glasgow*, "Production of the English Electric P.1," by G. H. Taylor; *Luton*, "Missile Reliability," by E. H. Ingomells. Mar. 4, *Brough*, "Aircraft Carriers," by J. C. Lawrence. Mar 5, *Cheltenham*, "Experiences of an Airline Pilot," by Capt. O. P. Jones.

AIR COMMERCE

ARGOSY BREAK-THROUGH

IT was announced last Monday that Riddle Airlines, the U.S. all-cargo operator based at Miami, has ordered a fleet of AW.650 Argosies (four R-R. Dart 526). This is the first commercial order for Armstrong Whitworth's private-venture transport, and it comes soon after the substantial R.A.F. contract for the military 660 version.

The number of aircraft bought by Riddle is not announced, but it is understood to be four. Nor is the precise value of the order revealed: but it is probably of the order of £3.5m with spares. The fact that an initial production batch of ten Argosies is already in hand at Coventry suggests that deliveries to Riddle could begin soon after certification, which is due next spring. A demonstration aircraft will be handed over for route-trials before production deliveries.

Riddle are the fifth largest U.S. air-freight carriers. In the year ended June 30, 1958, they produced 26 million ton-miles on their scheduled services. They operate 32 C-46s (a large proportion of which are C-46Rs) and three DC-4s, and occasionally they lease a DC-6A. Their scheduled route-network links Miami and other points in Florida with the big cities of the Eastern Seaboard and the Great Lakes.

A year or so ago, before Mr. George L. Giles took over the presidency, Riddle were in poor shape. They were losing more than five cents on every ton-mile they flew, largely owing to the marginal economics of the C-46. Since Mr. Giles took over the cost of each ton-mile has been cut by more than three cents—a saving accomplished despite the fact that the airline's freight handling costs run as high as five cents per ton-mile, one-third of this figure being due to manual labour costs alone.

This is the businesslike background to the choice of the Argosy, whose design for quick turnrounds should cut Riddle's high freight-handling costs to a fraction of those incurred by the C-46s. And the new freighter's operating cost, Riddle estimate, will be 30 per cent below that of the C-46. (Ton-mile cost of the Argosy averages 10 cents, which suggests about 15 cents for Riddle's C-46s.)

In terms of productivity one Argosy should do the work of three or four C-46s; thus four Argosies can be expected to take over the work of 16 C-46s—the number actually allocated to Riddle's scheduled routes (the other sixteen being engaged on U.S. military "Logair" contracts).

An order from such a tough customer can fairly be described as a break-through for A.W.A.'s new transport.

THE GATWICK ACCIDENT

ON February 17 a Viscount 794 of Türk Hava Yollari, carrying Mr. Adnan Menderes, the Prime Minister of Turkey, crashed at Jordan's Wood on the Rusper - Newdigate road while making an approach to Gatwick Airport. Mr. Menderes—who was seated in the rear fuselage—escaped practically unhurt. There were nine other survivors, but fifteen of the passengers and crew (including four pilots who were on board) and Abdullah Parla, managing director of T.H.Y., lost their lives.

The accident occurred at 1647 hr in weather conditions that Mr. Harold Watkinson, Minister of Transport and Civil Aviation, gave in the House the following day as "about one nautical mile horizontal visibility and one-eighth cloud at 800ft." The Viscount had been diverted from London Airport.

A report from the pilot said that he was located on the Gatwick I.L.S. when about 4½ miles from the airport. The approach was monitored by Gatwick radar, although G.C.A. was apparently not used. Radar contact was lost when the aircraft crashed about three miles from the runway. After the accident seven other aircraft made approaches and landings using I.L.S.

The Turkish Government have asked to be associated in a full inquiry. Turkish military and airline officials have inspected the scene of the accident and will assist in the investigation.

INDEPENDENT TROOPING CONTRACT

THOUGH nearly a year has passed since the independent airlines submitted their first tenders for the Air Ministry trooping contracts based on the use of the three M.o.S. Britannia 252s, no award has yet been made.

There has now been a new development: R.A.F. Transport Command are considering the possibility of operating the aircraft themselves, in advance of delivery of the 20 Britannia 253s which the Command has on order.

The trooping tenders now being submitted assume the use of aircraft other than the three M.o.S. Britannias. It is likely, of course, that preference will be given to those independents who are able to offer Britannias; but it is not clear why the visionary idea of 1955—whereby the Government ordered three Britannias for trooping by independents who could not afford to buy such aircraft themselves—has failed to materialize. A probable reason is that the special cargo-passenger configuration of the Britannia 252 did not offer the optimum economy for the predominantly passenger-carrying type of work involved, and indeed some independents feel that the cheapest job can be done by the "straight" Britannia 300 or 310.

About to sign the provisional contract for a fleet of AW.650 Argosies is (seated right) Mr. George L. Giles, president of Riddle Airlines Inc. of Miami. Next to him is Mr. C. S. Emery, sales director of Sir W. G. Armstrong Whitworth Aircraft. Standing behind them are members of the Riddle and A.W.A. teams. See first story

There are three such Britannias in independent use at present —one with Air Charter and two with British and Commonwealth (one of these, though accepted, is not in operation). The trooping contract would require the use of three Britannias at a rate of 2,000 hr per year, thus leaving the operator with about 1,000 hr in hand for commercial work.

Should orders for new Britannias be forthcoming as a result of the trooping contract, they could be met with reasonable promptitude: Bristol still have two of the five ex-Northeast 305s available for early delivery, and behind the new aircraft for Cubana and El Al on the Filton assembly line are several 320-standard aircraft for unannounced purchasers.

DIFFERENTIAL DEADLOCK

ON February 16 the I.A.T.A. traffic conference resumed the discussions abandoned at Cannes last October. The issue, that of the fare differential, surpasses in its contentiousness anything which I.A.T.A. has ever had to resolve before. Even the turbulent economy fare controversy of 1957 pales by comparison.

A meeting during the week before the full Paris traffic conference failed to reach agreement—despite the increasing behind-the-scenes discussions which had gone on since Cannes. As is well enough known, Alitalia, fully supported by the Italian government, want a hefty jet surcharge to protect their business until they, too, have jets. They will not accept any of the compromises so far put forward, which include the reserving of economy-class traffic to propeller airliners, and even the offer to apply a small (two per cent) surcharge on jets. Nor will they accept a propeller "subcharge."

The Italians now have a great weight of airline and government opinion against them. The one real hope of a settlement lies in the belief that Alitalia will, at this eleventh hour (government approval of existing fares expires on March 31), rate their need for long-term goodwill higher than their need for a short-term commercial advantage.

The fare-differential controversy has moved a long way from the original, most reasonable suggestions that: (1) A differential is necessary because it will put a brake on the present uneconomic speed-competition, and thus fostering the development of low-cost vehicles: (2) That its application should, initially, take the form of a small discount on all classes of propeller service.

Meanwhile, without much attention having been drawn to it, the American C.A.B. have approved jet surcharges on U.S. domestic jet services. In America, therefore, the principle of the fare differential is established.

As expected, the A.R.B. now require that the altimeters of all Britannias, Comets and Viscounts are changed for Kelvin Hughes' design shown on the left. The change must be completed by September 30 and applies to all aircraft operating above 20,000ft that are certificated from now on

AIR COMMERCE . . .

JET MOVERS

ONE of the problems of jet-transport servicing is how best to move aircraft about an airport. The first jets in service are being taxied to the apron under their own power, and positioned on the airport by the use of very powerful tugs. But, as numbers increase, the rising volume of airport noise may make it desirable to stop jet engines on the runway turn-off, and not to start them again until the runway holding point is reached at the start of the next flight.

The Turbo-Tug is the solution proposed by Napco Industries Inc., of Minnesota, U.S.A., to the problems that arise when heavy aircraft are positioned by an external aid. There is a clear distinction between a tractor, which has to be very heavy (in order to ensure wheel adhesion) and a tug such as this, which relies on the weight of the aircraft for traction and can be quite light. In fact, the prototype Turbo-Tug, which is illustrated here, was designed to move the Boeing B-52 and to be transported in the aircraft. There are obvious possibilities of coupling up the tug so that, in the air, it becomes an auxiliary power unit for the aircraft.

While such an application is unlikely in civil use, it is important for the tug to be agile, to be capable of rapid coupling to the aircraft (the action must not delay the landing rate at a busy airport) and to be able to move an aeroplane weighing more than 300,000 lb at quite high speed.

The prototype Turbo-Tug, for military use, is powered by a Boeing 502-10C gas turbine, both to reduce the weight and for easier starting at temperatures of down to −65 deg F. For airline use the tugs will be equipped with a range of piston engines, their size determining the rate at which the aircraft can be moved. For example, it is stated that the Model 130-R-500HP can move a 300,000 lb aircraft at 30 m.p.h. or one weighing 250,000 lb at 35 to 36 m.p.h.; and that a version equipped with the 170HP Model 16427 Continental engine will move a 300,000 lb aircraft at 10 m.p.h. All models are equipped with a Boeing 502-11B gas turbine compressor as a continuous air source for engine starting, for checking the pneumatic system of the aircraft, and for defrosting the wings or control surfaces. The compressor also drives an alternator supplying between 60 and 75 kVA, 400 c/s, 208 V electrical energy to the aircraft systems.

Production Turbo-Tugs for civil aircraft will differ from the prototype in having a sloped and contoured rear deck and a detachable cab raised by 20in; the tug is not intended to be able to pass under the belly of the DC-8 or 707.

With the wheel-mover backed into position and coupled up, an aircraft can be made to perform all the manœuvres that are possible in normal taxying, and can also be reversed. Once the tug is in position the combination is completely under the control of the pilot in the cockpit and the aircraft brakes will if necessary override the traction of the tug.

In operation, an adjustable hook on the rear of the rug is fastened to the undercarriage so that the maximum load is taken through the jack attachment ball, and the drive is transmitted to the landing wheels through serrated drums chain-driven from the rear axle. The latter incorporates a limited-slip differential. As the tug operates a friction drive its weight need not be artificially increased as in the case of a tractor; the prototype Turbo-Tug illustrated weighs about 8,000 lb. During high-speed towing, the front wheels of future versions will be raised from the ground and the load carried on freely rotating castors; the wheel mover will then become an integral part of the aircraft.

Napco are offering the Turbo-Tug to airlines on a basis of outright purchase, on a five-year lease to be operated by airline personnel, or as part of a special towing service.

1958-59 LOSS FOR THE CORPORATIONS?

ACCORDING to a report in the *Daily Express* on February 20, B.O.A.C. are likely to have suffered a loss of more than £3 million during the financial year ending March 31.

The report, on which B.O.A.C. last week made no comment, states that six main reasons are likely to be given for the loss. These are the business recession, which affected traffic-growth; heavy capital interest costs, said to total about £3 million; substantial losses by the Corporation's associated companies; the engineers' strike; competition from independently operated Colonial coach services; and Britannia "teething troubles" on the Far Eastern routes.

Last week Lord Douglas hinted that as a result of last year's recession and B.E.A.'s "worst winter yet" (nearly 1,800 services have been cancelled since November) it would be "touch-and-go" whether B.E.A. would reach March 31 with a profit. However, B.E.A.'s January passenger-miles were 14 per cent higher than in January 1958, and mail and freight had expanded. "If this goes on," said Lord Douglas, "we may yet be able to attract sufficient traffic . . . to keep us out of the red."

THE LARGE IRREGULARS

AFTER seven years' investigation, the C.A.B. have reached a final decision in the large Irregular Air Carrier case. The primary purpose of this investigation was to establish whether certain non-scheduled carriers should be granted limited scheduled rights to cater particularly for peak traffic in excess of the capacity offered by existing scheduled carriers. Of 53 applicants only 23 have been awarded certificates of public convenience and necessity, and of these 11 have received rights for only two years. A decision is still pending on eight carriers, the remaining 22 applicants having been denied certification.

The rights accorded to the certificated carriers follow closely along the lines of the temporary exemptions granted by the Board to over forty supplemental carriers in 1955: the selected airlines will each be able to operate a maximum of ten round flights per month between any two points, these services being available to individually ticketed passengers and waybilled freight; and domestic charter flights may be operated without frequency restriction (a decision on overseas charter flights will be announced in the near future). To prevent carriers from collaborating with the object of circumventing the frequency restrictions, the Board specifically forbids joint advertising or integration of schedules.

The twelve carriers "whose qualifications are clear and strong" have each received a five-year certificate. These are American Flyers Airline (four DC-3), California Eastern Aviation (three L.1049H), Capitol Airways (19 C-46, two L.749), Coastal Cargo Co. (one L.749), General Airways (two DC-3, one DC-4), Johnson Flying Service (two DC-3), Overseas National Airways (four DC-6A, two DC-4), Southern Air Transport (one C-46, one DC-3), Standard Airways (two DC-3), Stewart Air Service (three DC-3, one Bell 47), Transocean Air Lines (four Stratocruisers, four L.749, three DC-4, one DC-3, three Albatross) and World Airways (two DC-4).

A further group of eleven carriers, "whose qualifications are acceptable or better but range below those of the first group," include the following: All American Airways (three C-46), Arctic-Pacific (two C-46, one DC-3, one Canso), Associated Air Transport (four C-46), Aviation Corporation of Seattle-Westair (seven C-46, two DC-4), Blatz Airlines (two DC-3), Conner Airlines (one DC-6, three C-46, one DC-3), Modern Air Transport (three C-46), Paul Mantz Air Services (about 26 aircraft), Regina Cargo Airlines (one C-46, one DC-4, two DC-6A), Sourdough Air Transport (two DC-3) and U.S. Overseas (ten DC-4, three DC-6B, two L.1049H).

These two views of the compact Napco Turbo-Tug show (left) the wheel mover coupled to the starboard undercarriage of a Boeing 707 and (right) the hydraulically controlled hook and serrated driving drums

The first major landmark in the flight testing of the Convair 880 was passed on February 3 when a Federal Aviation Agency certificate of experimental airworthiness was granted—a week ahead of schedule. The test programme is being conducted from Lindbergh Field, San Diego

CHICAGO GO-GETTER

THERE seems to be no stopping Chicago Helicopter Airways. Last year saw their passenger traffic double in volume, this expansion bringing the company the distinction of being the first helicopter operator anywhere to carry more than 100,000 passengers in any one year. Their passenger services only started in November 1956.

Underlying this rapid growth was the replacement of C.H.A.'s three S-55s by a new fleet of five S-58s. This allowed the annual seat-mileage to increase from 2.6m to 5.3m. Passenger-miles increased even more rapidly (from 0.9m to 2.0m), and seat load-factor rose as a result from 35 to 37 per cent.

Use of larger aircraft meant that aircraft mileage increased less rapidly (22 per cent). The S-55s have been sold, but the three Bell 47s continue to operate on charter to the postal authorities —a mail service which is soon to celebrate its tenth birthday.

Looking ahead, C.H.A. expect to carry some 150,000 passengers this year, peak traffic rising to 15,000 passengers per month and 750 per day.

An important factor in this success story is C.H.A.'s realization that traffic will only build up on short-haul operations (average journey length, 18 miles) if a high-frequency service is offered. Most of the company's services are now operated on an hourly basis.

PACIFIC WESTERN EXPAND

SHORTLY after publication of the Wheatcroft report, Pacific Western withdrew their application to operate transcontinental services across Canada. The reason for this action was the report's suggestion that—at the most—only one new carrier should be awarded a licence. It also stressed the need to review regional services, and this implied increased local opportunity for airlines such as Pacific Western.

When the Canadian Minister of Transport last month announced the award of a daily transcontinental service to C.P.A.L. he also referred to the need to strengthen the regional carriers. Pacific Western simultaneously announced their plan to take over T.C.A.'s service between Vancouver, Victoria and Seattle.

During the hearings of the transcontinental case T.C.A. revealed that their loss on the Seattle service in 1958 amounted to over $1 million. P.W.A. offered to take over the service using Super C-46s and claimed that standards would be maintained or improved. T.C.A. have accepted this offer, subject to the approval of their directors and of the Air Transport Board. As the Vancouver - Victoria - Seattle route is one of the most densely travelled in North America—last year's traffic amounted to over 300,000 passengers—this addition would represent a considerable strengthening of P.W.A.'s network. The airline is also planning for further expansion of scheduled services in Western Canada.

G.P.U.s FOR K.L.M.

AFTER long negotiations K.L.M. have chosen the ground power unit Model 6TS117 manufactured by Kromhout Motoren Fabriek D. Goedkoop Jr. N.V., Amsterdam. These are diesel generating sets giving 75 kVA rated output of 400 c/s current, and are suitable for most versions of the Boeing 707, Douglas DC-8 and Lockheed Electra. K.L.M.'s initial order is for eighteen units for servicing their JT-4 powered DC-8s.

Selection of a Dutch company was by no means a *sine qua non*, since K.L.M. drove a hard bargain and competition—particularly from Western Germany—was fierce. Briefly, the 6TS117 comprises a water-cooled, six-in-line, four-stroke diesel running at 1,714 governed r.p.m. driving a synchronous 75-kVA alternator through a flexible coupling. Since the latter absorbs 93 h.p. at full load (and the cooling fan a further 5 h.p.) there is ample power available for adverse altitude and temperature conditions; the rated b.h.p. is some 106-107 at an altitude of 3,280ft and an ambient temperature of 122 deg. F.

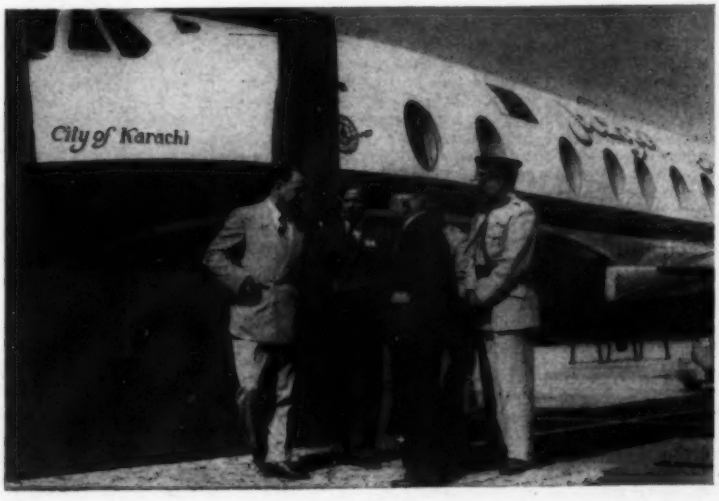
Features include a C.A.V. "Thermostart" for heating the intake air, close control of voltage (measured at the point where the cables connect with the aircraft) and frequency within plus/minus 4 per cent, a calibrated fuel tank with a capacity of 33 Imp. gal (8 hr running), a full set of headlights and obstacle lights, a spark-arresting exhaust pipe and provision for silencing and minimizing radio interference. Gross weight with full tank is 5,720 lb, and a self-propelled version has also been designed. Kromhout's representatives in Great Britain and the Commonwealth are Perman Engineering Ltd., 51 Woolwich Church Street, London, S.E.18.

ROTARY GET-TOGETHER

A MEETING of the world's leading helicopter airlines, under the chairmanship of Capt. J. W. G. James, flight operations director of B.E.A., took place in London earlier this month. Representatives of Alitalia, Chicago Helicopter Airways, New York Airways and Sabena, as well as B.E.A., attended.

The object was to "consolidate future thinking" on all aspects of commercial helicopter operations. Various decisions were reached. For example, it was felt that the best form of helicopter navigation aid is the hyperbolic, area-coverage system, with pictorial cockpit presentation. This "appeared to offer the most immediate promise for low altitude navigation, both in the terminal area and *en route*." (New York Airways' Vertol fleet is equipped with the Bendix-Decca Navigator system.)

As for heliports, it was found that city-centre heliports were compatible with the safety of multi-turbine helicopters, with their satisfactory engine-out performance; though it was agreed that all work on noise-suppression should be encouraged. The operators concerned are also "co-operating to the fullest extent" to achieve cockpit and cabin layouts standardized as much as possible to achieve the best efficiency, comfort and economy. It may well be that the airlines concerned, all of whom are I.A.T.A. members, have sown the seeds of future I.A.T.A. policy on commercial helicopter operations.



At a recent Karachi ceremony the first Pakistan International Viscount 815 was named by Gen. Ayub Khan, President of the Pakistan republic (left). He is seen here with Mr. Zafarul Ahsan, general manager of P.I.A. (centre) and Mr. M. A. Ispahani, the airline's chairman

AIR COMMERCE . . .

AIR EUROPE

IN Paris today, February 27, senior executives of the five European Common Market airlines—Air France, Alitalia, K.L.M., Lufthansa and Sabena—are due to meet for the second time to discuss their futures. This article discusses the general implications of that meeting. An article next week will review the subject in more detail

THERE have been many dreams about the future of European air transport. Economists in particular have long urged the rationalization of routes and equipment and bewailed the manifold wastefulness of political rivalry. In 1946, of course, such dreams as these came true in one part of Europe; the Scandinavians formed a common flag carrier, and today S.A.S. is one of the most efficient and respected airlines in the world.

Now Europeans are wondering how five other carriers—Air France, Alitalia, K.L.M., Lufthansa and Sabena—will be effected by the *fait accompli* of the Common Market, the economic entity comprising Belgium, France, Italy, the Netherlands, Luxembourg and West Germany. Will the airlines of these nations become one airline? Or will they retain their identities but pool their resources? Will the Common Market countries become one sovereign territory so far as traffic rights and air agreements are concerned? How is British air transport likely to be affected?

It is possible only to guess at the answers to these and many other questions. Of only two things can there be any degree of certainty: the five airlines will indeed move closer together economically, politically and commercially; and the future expansion of British air transport will not be made easier as a consequence.

At the end of January the heads of the five airlines concerned met in Brussels to hear one another's views about the place for their industry in the broader concept of Common Market economic integration. Nothing much was said after that meeting, though the magic words "Air Europe" were coined at about the same time. They may have been coined by a newspaperman; but some people believe that their author was M. Max Hymans, chairman of Air France. Whatever their origin, they captured—and indeed jolted—the imaginations of rival airlines. In one of the most presumptuous political pronouncements for many years, a U.S. State Department official in Washington—so it is reported—warned that "the airlines of the Common Market nations will face retaliation if they try to monopolize air traffic in their area. . . ." Any such monopoly would, said the official, subject the Common Market airlines to "immediate retaliation" on the Atlantic.

In London there were vague suggestions that the B.E.A. revenue-pool agreement with Air France was an indication of the way Britain could come to terms with the Common Market, though it was not generally noted that B.E.A. already has revenue-pool agreements with all the carriers concerned, and that such agreements already exist among those airlines themselves. The conception of an "Air Europe" could be very much broader and binding than a short-term revenue-pool agreement.

The first agreements will probably concern the pooling of equipment and technical resources. The scope here is immense: the integration of spares-holdings, the establishment of common maintenance facilities and the interchange of equipment are all immediate possibilities which could cut costs in a big way. These things can of course be achieved without a Common Market—as they have been achieved between S.A.S. and Swissair, whose DC-8, Convair 880 and Caravelle fleets are to be rationalized. But equipment-pooling will probably be the way in which Air Europe will warm up. Of the five airlines, three (Air France, Lufthansa, Sabena) have Boeing 707 Intercontinentals on order; and all five except Alitalia will be using P. & W. JT4s.

There is scope for many more engineering economies; four of the five (the exception being Sabena) operate Viscounts and Darts, and may do so for some years to come. And three have still to decide their medium-transport requirements—namely, Sabena, Lufthansa, Alitalia. It could well be that these carriers will now buy the Caravelle, a product of the Common Market.

The "homogenizing" of equipment is, indeed, likely to characterize Air Europe's future procurement. That there will be second thoughts about existing orders is unlikely. But it is a salutary thought for Britain—and for America—that the aircraft industries of the Air Europe countries concerned will in the long term be the preferred sources of supply. Already the aircraft industries of France and Western Germany co-operate closely; they can now look forward with the Italians to supplying an airline industry which serves a population (165 million) as big as America's.

The next foreseeable step will be the rationalization of routes and operations—intra-European first, overseas next. A great deal can be done along these lines once political barriers are down. One can visualize an Air Europe master-plan with objectives such as the intensification of "intra-Common Market" traffic volumes, aimed at improving that vital index of airline economics—load per route-mile. The route-map of Europe reveals the existing route pattern as a series of big cities with routes radiating from them ("hubs and spokes," as Lord Douglas has called them). This is a consequence of nationalism—each carrier concentrating its efforts on its own chief cities. But it is a costly consequence, because it results in high outstation costs, and too low an intensity of service-per-carrier on too many routes. With nationalism diminished the economic rationalization of routes would become possible and the air transport map of continental Europe might come to have more of the flow-pattern of the U.S. domestic map.

Some kind of joint air transport authority might also be formed. It would probably begin by tackling such a re-organization of routes and traffic quotas; and it is not too fanciful to imagine the possibility that when the economic ties mature—as they surely will—into political ties, the whole of the Common Market will develop into a domestic cabotage area, with its own internal fare structure, and with a unified sovereignty so far as air agreements with other nations are concerned.

The mind reels at the possible consequences of such a development. The whole sensitive apparatus of bilateral air agreements between France, Germany, Italy and Benelux and the rest of the world would collapse. The collective bargaining power of these nations would, of course, be immense.

No longer would it be easy (for example) for the C.A.B. to veto, under pressure from American carriers, an Air France request for U.S. West Coast traffic rights—because backing that request might be an Air Europe air transport authority with many more traffic-cards than Paris in its hand. Sanctions could be imposed on Pan American's or T.W.A.'s traffic rights at Amsterdam, Dusseldorf, Brussels, Rome—or at half a dozen other big cities.

Again, the British Government might not be so firm in rejecting—say—K.L.M.'s traffic rights at Singapore if it knew that British commercial rights at so many European cities other than Amsterdam might, to use the common euphemism, be "reviewed." All this may seem far-fetched; existing sovereignties and bilateral air agreements will of course remain valid for some time, and it would take several years for an Air Europe with such powers to formulate a common policy so far as international routes are concerned. It will be pre-occupied with putting its own new house in order. But such developments cannot be ruled out.

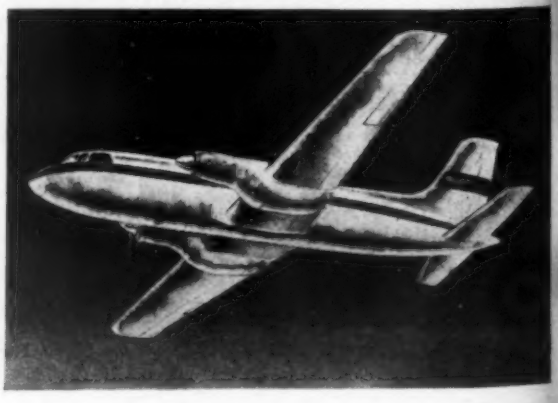
Could B.E.A.—whose interests will be the most affected by the changes now afoot—join an Air Europe? M. Willem Deswarte, director-general of Sabena, said in Brussels on January 31, "We do not want to exclude any other European airlines from joining us." He added that each company would retain "its own personality" under the integration scheme. This does not suggest that Air Europe is ganging up on anybody in particular: but many practical difficulties would face a carrier who wanted to join, if his country did not subscribe to the deeper economic ideals and obligations of the Common Market. There would be too many conflicts of attitude and aims.

But one thing is certain: now emerging is a consortium of air-faring nations which could become an extremely powerful political and commercial force in the air transport operating—and manufacturing—world of the future.

J. M. R.

AVRO 748

Here, based on the first official sketch to be published, is an impression of the Avro 748. As might be expected from its twin-Dart, low-wing configuration, it bears a striking resemblance to the Accountant



CANADIAN SWING-TAIL

CANADAIR are now offering a novel form of rear loading as a standard feature for both civil and military versions of the CL-44. The aircraft is to use a sideways-swinging tail, and a lowered rear floor on to which objects of up to 100in in height and width can be loaded by means of a ramp, snatch-blocks and floor-mounted winch carried within the aircraft. Civil versions are being offered for delivery in November 1960. The gross weight (205,000 lb) of the swing-tail civil CL-44D (military designation CL-44G) with rear loading remains unchanged, but a new figure of 65,000 lb has been quoted for payload.

Announcement of a swinging tail for the CL-44 which will replace the original 120in by 78in loading doors in the fuselage side, shortly preceded the announcement by the General Dynamics Corporation of a similar arrangement (illustrated below) for the Convair 600. In this case, the aircraft will be equipped with a "kneeling" undercarriage to permit loading at truck-bed height.

While a swinging tail is aerodynamically efficient, the attendant engineering problems are not easy to solve, particularly with a pressurized fuselage. The A.W.A. Argosy swinging rear door does not, of course, involve the additional weight of the fin and rudder incumbent in a swinging tail, nor does it require a break in the flying control runs and electric and hydraulic pipe lines. The latter difficulty led to the abandonment of the swinging nose at one time projected for the Accountant.

In the solution proposed by Canadair there are two large external hinges spaced on a 90 deg segment of the fuselage, with a hydraulic actuator operated by the aircraft A.P.U. opening and closing the rear fuselage. Tension and shear loads are transmitted by nine peripheral latches, and an inflatable seal is used to prevent loss of pressurization. Considerable loading is imposed on the structure around the hinges, and frame-deflections and fuselage-sag with the tail open have been investigated at wind speeds of up to 60 m.p.h. Hinges, actuator and latches are backed up by stiff frames, longerons and intercostals, and extreme deflection should not exceed ½in vertical mis-alignment at the side of the fuselage opposite the hinges, or less than ¼in local frame deflection.

This deflection is accommodated by a spigot and roller system designed to align the two halves during closing, and by chamfering the two shear pins of each latch. Adjustment is by serrated plates, and the tension in the latches can be varied by means of eccentric pins.

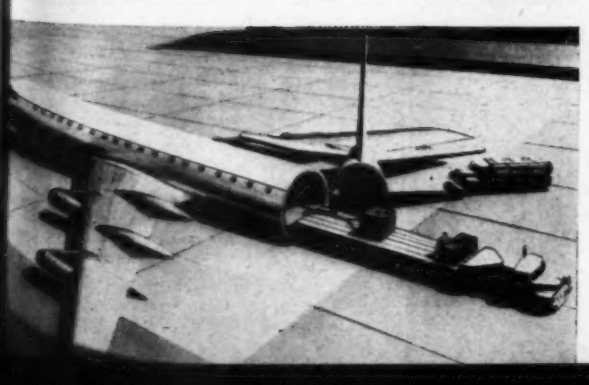
For simplicity, separate latches were adopted in favour of an automatic hydraulic locking system. As a safety precaution, the latch locking handles (which are recessed into the structure) can be pulled only by squeezing a lever, and a double locking action has been adopted. The first 45 deg movement of the handle moves the hook away from the latch pin and the last part of the handle movement lifts it clear of the pin, allowing the joint to separate. If there is tension on the joint, the second motion cannot be initiated. Micro-switches and interlocks prevent take-off power being selected until all the latches are free.

Electrical and hydraulic runs are flexibly jointed and the flying control runs are broken at bevel-gear boxes on each side of the fuselage joint. These transfer the rotary motion of the torque tubes to a pair of oscillating levers. These transmit control movements by direct contact when the fuselage is closed but separate when it opens; there are no connections or locks.

Some additional equipment has been included in the CL-44D to take advantage of the new loading arrangements. A modular ramp, constructed in sections weighing 200 lb each, can be dismantled and carried in the aircraft; and the rear floor—now two feet lower than formerly—is provided with lashing points and a 20in grid and seating rails. The floor has also been stressed to 700 lb/sq ft where vehicle wheels or tracks are in contact.

No mention is made by Canadair of external support for the fuselage or tail (although one is shown in the upper photograph) and it is clear that the hinges and structure must withstand substantial loads when the tail is open. Nevertheless, the company claim to have saved 1,000 lb empty weight over the early side loading door arrangement.

Announcements of swing-tail versions of the CL-44D (top) and Convair 600 have established a vogue for this design for rear loading. Low loading is achieved in the Convair design with a kneeling undercarriage. The CL-44D has a lowered rear floor



BREVITIES

IT is with much regret that *Flight* records the death, on February 10, of Mr. C. B. Collins, O.B.E., at the age of 62. He was in the M.T.C.A. as a technical adviser on airports, and his death breaks the last personal link between the present Ministry and its predecessor, the Civil Aviation Directorate of the Air Ministry. He leaves a widow and a son and daughter.

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B.O.A.C. have taken delivery of their eighth Comet 4. The remaining six will be delivered between April and August.

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A Fokker Friendship has been ordered by the Philippine Government as a presidential aircraft.

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The 100-seat Tu-104B has completed flight tests and is expected to go into Aeroflot service shortly.

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Sabena total traffic increased last year by 17 per cent. Expansion of short- and medium-haul operations caused a particularly large (24 per cent) rise in passenger traffic.

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The New Zealand government is reported to have denied Canadian Pacific permission to replace DC-6Bs with Britannias on their Auckland service.

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B.O.A.C. ask us to correct two errors in the article "Eastern Routes Jet" (February 13). The Comet's undercarriage limit speed should of course be 185 kt, and not 125 kt; while the 2,300 kg minimum fuel reserve allows for a descent from 5,000ft and includes 15 min holding at that height.

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The Air Transport Advisory Council has set target dates this year for applications for future inclusive and circular tours: March 26 for winter 1958-59, and June 26 for summer 1960. (Of 424 applications received by the last target date for this year's tours no fewer than 254 arrived on the actual target date.)

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A newcomer to the Canadian scheduled scene is Sarnia Airlines, a company recently formed to operate scheduled services within Ontario. At present restricted to an area lying south-west of Toronto, operations include services on a twice-daily basis between Windsor, Sarnia, London and Toronto. Doves are used.

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Mr. John Morgan has been appointed acting chairman of Cambrian Airways in the temporary absence overseas of Mr. J. Watts. W/C. L. B. Elwin will now be the sole managing director. The previous joint managing director, Mr. W. W. Stanley, will continue as company secretary. It is now confirmed that Cambrian Airways' services this summer will be operated by three DC-3s on charter from B.E.A.

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The report of the official Indian inquiry into the Pakistan International Convair 240 take-off accident at Delhi last May states that the probable cause was "that the commander did not properly observe and interpret his flight instruments and thus, inadvertently, caused the aircraft to descend to the ground." A contributing factor, it adds, may have been "slow reactions due to his state of health."

SERVICE AVIATION

Royal Air Forces and Naval Flying News

Royal A.D.C.

AMONG recently appointed Naval Aides de Camp to the Queen is Capt. R. M. Smeeton, a former captain of H.M.S. *Albion*. At present Director of Plans at Admiralty, he succeeds Rear Admiral R. E. Portlock as A.D.C., with effect from January 7.

Exchanging Jobs

HAVING commanded R.A.F. Hawkinge since June 1956, G/O. J. L. A. Conan Doyle is to be Inspector of the W.R.A.F. from April 22; and she will be succeeded at Hawkinge (from April 8) by G/O. F. B. Hill, who has been Inspector of the W.R.A.F. since May 1956.

G/O. Jean Conan Doyle, who is the daughter of the late Sir Arthur Conan Doyle, held the post of Inspector of the W.R.A.F. before going to Hawkinge.

Cook's Tour

MAKING a long-range operational flight to the Canary Islands area, a Shackleton M.R.3 of No. 206 Sqn. last week set up a new endurance record of 24 hr 21 min. Flying under full Coastal Command operating conditions, the aircraft (captained by F/L. D. R. Foster) took off from R.A.F. St. Mawgan on February 17 at 1421 hr and landed back there at 1442 hr on February 18. The crew of 13 included three pilots (taking it in turn to do an hour's flying then an hour as co-pilot, followed by an hour's rest), three navigators, four signallers and a cook.

Portsmouth Post

FORMERLY D.C.N.S. and Fifth Sea Lord, Vice-Admiral Sir Manley L. Power has been appointed Commander-in-Chief, Portsmouth, from next month with the acting rank of admiral. In this post he succeeds Admiral Sir Guy Grantham, and he will also have the NATO appointment of Allied Commander-in-Chief, Channel.

Admiral Power was Flag Officer Aircraft Carriers before becoming D.C.N.S. in October 1957, and during Operation Musketeer (the Suez landing) commanded the Anglo-French Carrier Group. He won the D.S.O. in 1944 for actions against enemy E-boats during the Normandy landings, and in 1945 a Bar to it for his destroyer flotilla's successful operation against the Japanese heavy cruiser *Haguro*, in what proved to be the last major surface gun and torpedo action of the war.

Explaining the R.A.F.

SIX officers of the R.A.F. Staff College at Bracknell, Berks, are leaving the U.K. by air on March 29 for a fortnight's visit to the United States and Canada. Led by the assistant commandant, A. Cdre. J. R. Gordon-Finlayson, they are to lecture on the Royal Air Force to the U.S.A.F. Air Command and Staff College (at Maxwell A.F.B., Alabama) and to the R.C.A.F. Staff College at Toronto.

Maritime Propensities

THE University of London Air Squadron's prospects of pulling off a "Hack trick" by winning the Hack Trophy for the third year in succession—and therefore of keeping it permanently—have been dimmed by change and reduction in instructor strength and aircraft, and by a move from Biggin Hill to White Waltham which is much less accessible and has "maritime propensities" in winter. These feelings were expressed by the C.O., W/C. V. Rees, at the squadron's annual dinner in London last Friday.

Proposing the health of the squadron, Air Marshal Sir Edmund Hudleston, the V.C.A.S., said that only financial considerations prevented the R.A.F. from doing more for the U.A.S.s, although it would try to improve equipment to keep pace with front-line developments. Biggin Hill had been closed because it was too small to accommodate an operational squadron and too expensive without one.

Discussing prospects for future R.A.F. pilots, Sir Edmund said that until 1970 a minimum of 2,800 flying posts would exist in the Service. This would require 280 new pilots each year with initial recruitment of 450 to allow for wastage in training. A pilot could expect to fly for ten to 15 years in his first 20 years of service—just as his pre-World War 2 predecessor had done. As for aircraft, a new fighter, a strike aircraft and two transports had been ordered and much research was in hand on other types. The increased technical education already being given at Cranwell would become a general requirement for all pilots in future.

Air Marshal Sir Richard Atcherley with the portrait presented to him by the C.A.S., Marshal of the R.A.F. Sir Dermot Boyle, at Flying Training Command H.Q. last week (this page February 13, and leader this week)

IN BRIEF

Air Marshal Asghar Khan, C-in-C. of the Pakistan Air Force, has been appointed Pakistan military adviser to SEATO.

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Avon-Sabres of Nos. 3 and 77 Squadrons of the R.A.A.F., based at Butterworth in Malaya, are to be equipped with Sidewinders.

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This year's R.A.F. aircraft recognition competition, in which 47 teams are participating, will be held at the Science Museum, South Kensington, London, S.W.7, on Saturday, March 14, at 2.30 p.m.

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Prince Bernhardt of the Netherlands has been invited to open the Air Week organised by the Brighton branch of the R.A.F.A. for May 30-June 7 and to attend the opening air display at Shoreham Airport on May 30.

RETROSPECT

From "Flight" of February 27, 1909

Aviation in Parliament: Replying to Mr. Fell, Mr. Haldane, in Parliament last week, said that the future policy, as regarded aeroplanes and dirigible balloons, was now receiving very careful consideration, and accordingly at the present moment he was not in a position to give information on the subject.

Mr. Fell: "Does the right hon. gentleman consider that the results up to the present time have been satisfactory?"

Mr. Haldane: "All that had better be answered when I go into the whole subject."

In answer to a further question, Mr. McKenna said that the use of dirigible balloons for work in connection with the fleet was being considered.

On Tuesday, in replying to Mr. Macpherson, who asked how much public money had been spent up to the present by the War Office on experiments with aeroplanes and dirigibles, Mr. Haldane said the amount was about £19,000. Mr. A. Lee then asked if any steps had been taken by way of expenditure to acquire the services of the Wright Brothers, but Mr. Haldane said he would rather not answer that question at present.

King Hussein with Jordanian Air Force officers at a recent party given by them to R.A.F. instructors, who are (standing, extreme left) S/L. Bennett, (kneeling, left to right) F/Ls. Catt, Carter, Entwistle, Browne and (standing, second from right) Clarke

THE MALAYAN EMERGENCY